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ABSTRACT

The study examines the increasing levels of female labor in the economy over the period between 1940 and 1970. Married women with husbands present show the most pronounced increase in participation rates with increases in every age group. Chart 1 and Table 1 present data on the percentage of women in the U. S. labor force over this period by both age and marital status. Table 2 provides statistics on the contribution that working wives make to family incomes. In dealing with the question of female status and mobility for the Unites States' (1940-1970) and New York State (1960-70), occupational areas were defined and examined: professionals, managers, clerical workers, craftsmen, operatives, service workers, and laborers. Tables 3 and 4 and Appendix A illustrate the results. New York showed a stable rate in female employment in clerical occupations, a decrease in manufacturing and laborer occupations, with an increase in medicine and other professions, contrasting with some of the national norms and reflecting a combination of factors. Twelve measures of female/male occupational mobility; indexes of the seven occupational groupings for both New York and the U. S. in graphic form, and a summary of the methodology are appended. (JB)

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STRUCTURAL CHANGE IN THE OCCUPATIONAL COMPOSITION OF THE FEMALE LABOR FORCE

by Ethel L. Vatter*

Women have been entering the paid labor force in increasing numbers during the past several decades, as can be seen from Chart I, which shows not only increasing levels of participation over the life cycle but also a changed pattern of participation between 1940 and 1950 to 1970. Current expansion is notable among married women, as can be seen in Table 1. Married women with husbands present show the most pronounced change in participation rates between 1940 and 1970. What begins as a change rate of 7.8 percent for 1940-1950 accelerates to a change rate of 10.2 percent for 1960-1970. Also, in every age subgroup there has been an increased participation rate. By contrast, single women, although having higher participation rates than married women, show no consistent trend of increasing labor force participation. However, the 10.1 increase in participation of single women for the 1960-1970 period is comparable to that of married women with husbands present. All other-ever-married women ranked higher in participation rates than married women with husbands present and have shown gradual increases throughout the 1940-1970 period.

One could speculate on the reasons for increased participation of married women with husbands--obviously the major group available for additions to the aggregate supply of labor--and treat participation as a function of freedom of the married female to make choices as to whether and when she will enter the paid labor market and how long she will remain in it. The major factor keeping married women's participation rates lower than thoseof single women is, of course, the responsibility for "serving" families, including the bearing and rearing of children. Chart 1 depicts the dramatic changes that took place in female labor force participation after 1940.

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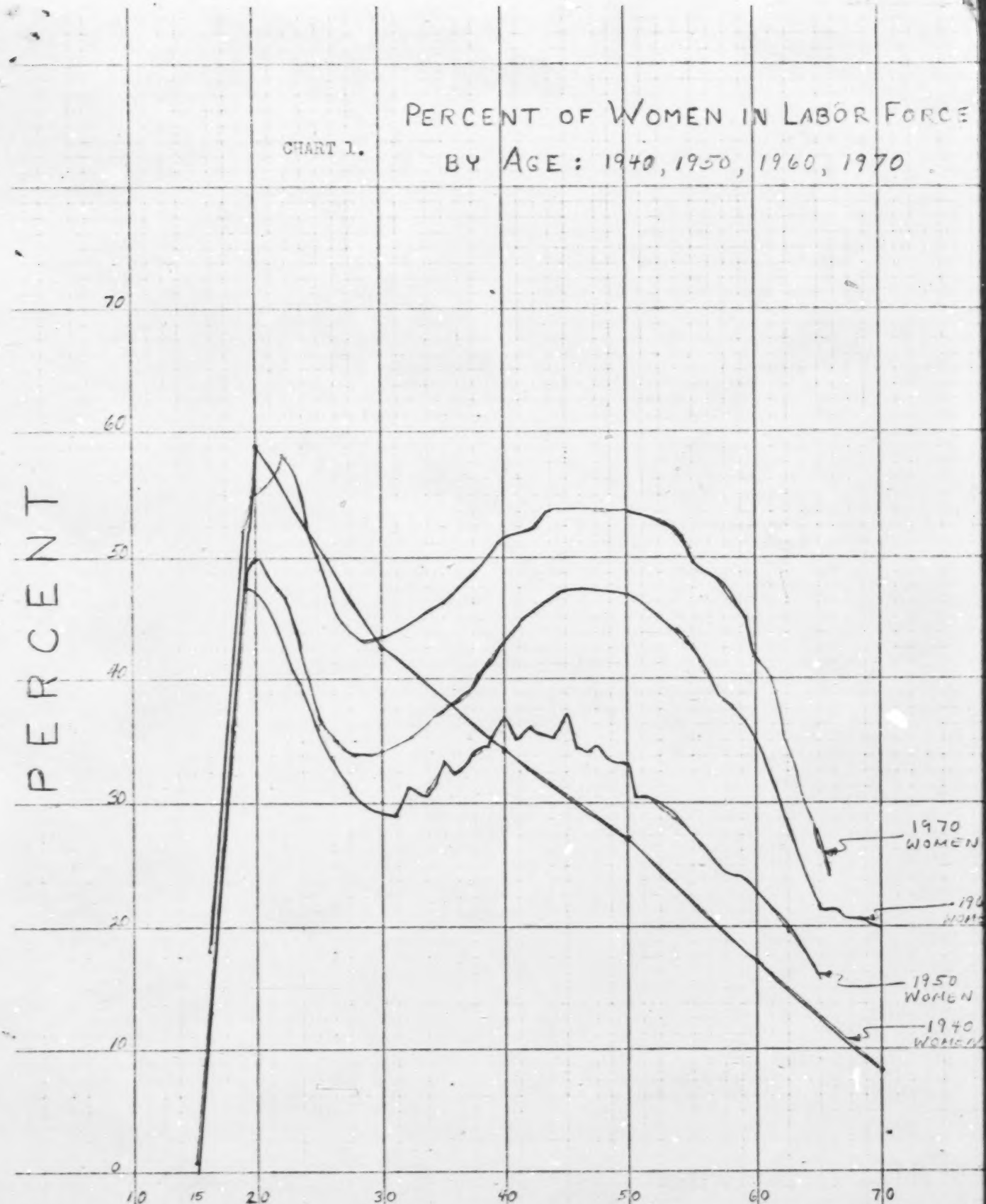
CHART 1.

PERCENT OF WOMEN IN LABOR FORCE BY AGE: 1940, 1950, 1960, 1970



Source: 1940-Census of Population, Summary Vol. 3, p. 1969.
1950, 1960, and 1970: Occupation, Employment, and Lifetime Experience of Women, Larry E. Suter, U.S. Dept. of Commerce, Census Bureau, unpub. MS 19

Table 1. Labor Force Participation Rates of Women by Age and Marital Status, 1940-70

Age and Marital Status	1940	1950	1960	1970
Married, husband present				
Total, 14 years and older	13.8	21.6	30.6	40.8[a]
14-19	9.3	19.4	26.0	36.0[b]
20-24	17.3	26.0	31.1	47.4
25-29	18.5	22.1	26.8	38.4
30-34	17.6	22.5	29.0	40.2
35-44	15.3	26.5	36.5	47.2
45-54	11.1	23.0	39.3	49.5
55-64	7.1	13.1	25.2	32.4
65 and older	2.8	4.5	6.8	7.9
Single women				
Total, 14 years and older	45.5	46.3	42.9	53.0[a]
14-19	19.7	22.8	23.3	39.5
20-24	73.1	73.3	73.2	71.1
25-29	79.5	79.8	79.1	82.5
30-34	77.7	77.9	79.4	77.2
35-44	73.4	75.7	78.2	73.3
45-54	63.5	70.7	76.1	72.3
55-64	47.2	57.2	64.8	63.7
65 and older	16.9	19.7	23.0	17.6
All other-ever-married women[c]				
Total, 14 years and older	33.7	35.5	38.7	39.1[a]
14-19	34.6	37.0	35.3	46.9[b]
20-24	57.0	54.3	53.9	59.7
25-29	63.9	59.3	58.2	66.0
30-34	66.6	62.4	62.2	64.0
35-44	61.9	65.7	68.2	67.9
45-54	46.6	56.2	67.3	69.1
55-64	26.8	35.8	47.6	54.6
65 and older	6.2	7.8	10.6	9.9

Source: Tsuchigane, Robert and Dodge, Norton. Economic Discrimination Against Women, D.C. Heath and Company, 1973, pp. 111-112.

[a] 16 years and older.

[b] 16 to 19 years.

[c] Includes widowed, divorced, and married women with husband absent.

Note that in 1970 for the 25-29 and 30-34 age groups married women with husbands present had below average participation rates of 38.4% and 40.2%, whereas single women in these corresponding age groups had their highest participation rate of 82.5% and 72.2% respectively. However, looking at the 1960-1970 change in participation rates, one finds that the child-bearing/rearing factor may be losing its strength. The increases in participation for married women with husband present were greatest for those of prime child-bearing ages--20 to 35.

Of special significance has been the entry into the labor force of women with small children "... in March 1970, one-fourth of all married women with children under 3 years of age were part of the American labor force. The proportion was one-third for those whose youngest children were 3 to 5, and one-half for those whose children were old enough to be in school."[1] By 1972, the percentages for working mothers with children under 3 had increased to 28, and to 32 for those with children under 6. Two questions can be raised at the outset: (1) why are mothers in increasing numbers entering the paid labor force and (2) what changes, if any, have occurred in the status of women in the paid labor force, given their increasing participation? Although this research is primarily concerned with the latter question, a quick response to the first is in order.

Data on the contribution that working wives make to family income (Table 2) lend credence to the hypothesis that need is the main goad at low-income levels, want at middle-income levels, and desire for self-actualization at high income levels, although these concepts are not mutually exclusive.

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[1]"Marital and Family Characteristics of Workers, March 1970," Elizabeth Waldman and Anne M. Young, U.S. Department of Labor, Monthly Labor Review, March 1971.

The median contribution to family income is highest at the two extremes of family income. As family income increases, the percentage contribution shifts away from the less than 5% contribution and greater than 50% contribution extremes toward the moderate 5 to 30% and 30 to 50% contributions. Need is most certainly the primary factor at the under $2,000 family income level. Self-actualization may be a major factor for income levels greater than $15,000 when one considers that most occupations in which females make over 30% of $15,000 (i.e. over $4,500) require some skills and work may indeed satisfy the desire to utilize them. The want to improve the real level of living probably functions for women at both middle and higher family income levels.

Table 2. Distribution of Wives by Selected Percentages Accounted for by Earnings

	Median Contribution	Less than 5.0%	30-50%	Over 50%
Under $2,000	28.4	22.4	11.9	36.6
2,000-2,999	21.8	15.6	13.9	24.7
3,000-4,999	24.8	13.4	17.2	25.2
5,000-6,999	22.8	15.3	19.7	21.8
7,000-9,999	23.9	13.8	26.2	14.1
10,000-14,999	27.6	10.2	38.1	9.7
15,000 and over	27.9	7.8	38.1	7.0

Source: Adapted from Special Labor Force Report 144, U.S. Department of Labor, March 1971.

The need, self-actualization, and want to increase real level of living concepts present an interesting mix of economic and psychological factors -- now that aspirations and educational levels are rising, along with unemployment and prices! Since we may expect these trends to continue, we may also expect that increasingly women will less and less regard themselves as secondary, supplementary, or peripheral workers and more and more be concerned with their labor force status.

To answer the question of whether or not status has (1) worsened, (2) improved, or (3) remained unchanged, for the U.S. from 1940-1970, and for New York State from 1960-1970[2], we now turn our attention to a number of indices whose computation is based on the application to Census data of a variety of assumptions.[3] They are discussed briefly below and in greater detail in appendices C-1 and C-2, pages 38-50.

The first index is expressed as follows:

a = a gross measure of relative status, or $\frac{\bar{f}}{\frac{F}{L}}$ where $\bar{f} = \frac{\Sigma(\frac{f_1}{l_i})}{N}$

Here a is deemed to be an inadequate measure because it is computed as if each occupational group contained the same number of women, and were of equal importance (status). $a' = (\Sigma(f_i/l_i)SES_i)/(\Sigma(F/L)SES_i)$ seeks to avoid the failure to account for importance by using SES scores of occupations.[4] In this case a' is weighted measure of bias. The weight is the SES group number (the numbers range from 1 to 99 for approximately 500 occupational categories). The percentage of women in each occupation is multiplied by the SES number for that occupation. These are summed and the total is divided by the sum of the percent contribution of women to the total labor force times the SES group numbers. Thus, the SES group numbers (1-99) act as weights, and deviations from $\frac{F}{L}$ in higher SES occupations are given, proportionately, greater weight.

Does a' = .x actually represent what it purports to represent? Can we conclude that the relative status of women in 1970 is about 66% of that of men in 1970? Here, there are at least two considerations: (1) a' may not

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[2]Comparable data for 1940 and 1950 for New York State are not available.

[3]For alternative assessments, see: Edward Gross, "Plus ca change...?", Social Problems, Vol. 16, pp. 198-208; Duncan & Duncan, "Index of Dissimilarity," American Sociological Review, Vol. 20 (April 1955), pp. 210-217; Economic Report of the President, Jan. 1973, supplement to Chapter 4, pp. 155-159.

[4]See Methodology and Scores of Socioeconomic Status (SES), Working Paper No. 15, U.S. Department of Commerce, Washington, D.C., 1963 for details of the methodology involved in arriving at these scores. Income and maintenance are the primary inputs.

actually measure the relative position of women, in which case another measure must be developed and (2) even if the measure does reasonably reflect the extent to which women have less percentages in occupational groups than they contribute to the labor force, the fact remains that men have correspondingly greater percentages in occupational groups because their overall participation in the labor force is so much higher than women's, and a' does not measure women vs. men but rather women vs. a given norm. It may be argued that the relative position of women vs. men would be lower than the relative position of women vs. a given norm, that men are favored to the same degree that women are disfavored, and that a credible measure might be expressed as follows:

> 1+ (1-a) = the ideal index on the assumption that the bias against women is equal to a bias in favor of men.

And therefore

> a" = a'/(1+(1-a') = measure of status of women relative to men. The figure for 1970 is 0.49.

Here a" although it is a quick and easy index to prepare is rather arbitrary in construction and suffers from some other faults, mainly, a discontinuity of a" when a' = 2 (see Appendix C-1 for further explanation).

A more appropriate method of measuring female/male status would be to construct an index of man's status (b') relative to some ideal norm analogous in construction to the a' index with the use of m_i/l_i in place of f_i/l_i and M/L in place of F/L, and to form an index of status of women to men as c' = a'/b'.

When dealing with groups of occupations less than the total labor force in size, one can consider the "participation rate"[5] for that group in the total labor force. One can construct an index which takes into account the distri-

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[5]Defined as a ratio of the percent of women found in a particular occupation to the percent of women in all occupations combined, for a given census year. See Trends in Women's Occupations, New York State, 1960 to 1970, Labor Research Report 18, October 1973, New York State Department of Labor, N.Y.C., 10013.

bution of women throughout the group of occupations (in part a function of the a' index) as well as the participation rate. This index can be written as follows: $a''' = (\Sigma_k(f_i/l_i)SES_i)/(\Sigma_k(F/L)SES_i)$. "$\Sigma$" signifies summing overall occupations in the k^{th} occupational group and "F/L", the proportion of women in the total labor force rather than for the k^{th} group (as would be the case if we were constructing an a' index for the k^{th} group).[6] As was done for the a' index, one can also construct a b''' index in similar fashion and denote the ratio $\frac{a'''}{b'''}$ as c'''.

We can go a step further in the development of an index of female occupational status by trying to construct an index which also takes into account the criticism of not considering the total number of persons in each occupational category. One way to construct such an index using a function of the number of persons in any occupational category is to use the standard deviation of f_i/l_i.[7] The larger the standard deviation, the less important is the deviation of f_i/l_i from F/L. Therefore in computing an index using the standard deviation of f_i/l_i, one weights each component of the sum of the numerators as computed in a' by the inverse of the standard deviation. The inverse of the standard deviation varies in magnitude as the importance of the deviation of f_i/l_i from F/L varies in magnitude. The new index is written as follows:

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[6] When the k^{th} occupational group is the whole labor force, then there is no difference between the participation in the k^{th} group and in the total labor force, a''' becomes only a measure of distribution and is equal to a'.

[7] See appendix C-2 for complete explanation. If we assume an ideal labor pool in which the proportion of females qualified for any occupation of all persons qualified is equal to their proportion of employment in the total labor force, and that persons are hired to each occupation independent of one another (especially with no regard to sex) with the probability of a female being hired equal to the proportion of females in the labor force, then the proportions fi/li for each occupation should be binomially distributed with mean = F/L and standard deviation = SQRT((F/L) (1 - F/L)(1 - 1i/L)/1i)

$$A' = (\Sigma[(F/L)(1 - F/L)\ (1-l_i/L)/l_i]^{-\frac{1}{2}}(f_i/l_i)SES_i)/$$

$$(\Sigma[(F/L)\ (1 - F/L)\ (1 - l_i/L)/l_i]^{-\frac{1}{2}}(F/L)SES_i)$$

$$A' = \Sigma SQRT(l_i/(1 - l_i/L))(f_i/l_i)SES_i \ / \ \Sigma SQRT(l_i/(1 - l_i/L))(F/L)SES_i$$

Again this A' index is a measure of female status relative to some ideal status. One may construct a B' index for men's employment status analogous to the construction of A' with the use of m_i/l_i in place of f_i/l_i and M/L in place of F/L. C' = A'/B' is an index of women's employment status relative to men and is analogous to the construction of C'.

It is a simple step to the construction of A'", B'" and C'". They are similar in construction to their lower case counter parts except for the added weighting by the $SQRT(l_i/(1 - l_i/L_k))$ a function of occupational size for each occupation i and the size of the k^{th} group of occupations. Their construction is identical to that of A', B' and C' except that the summation in both numerator and denominator is over some group of occupations while the F/L and M/L proportions are for the total labor force. The triple prime indices here, as for their lower case counterparts, combine both a measure of fairness and participation rate.

The indices just constructed are all measures of status in the work force. Construction of all indices are summarized in Appendix C-1, pp. with the aim of easing interpretation. Capital letter and small letter indices measure similar categories but the capital letter indices compensate for size of occupation groups. Because of the adjustment for group size, the capital letter indices will be more reliable estimators of women's status, we believe.

Using these measures, we shall now examine the question of whether or not the status of women in the labor force has improved, worsened, or remained

constant during the period 1940-1970 for the U.S. and 1960-1970 for New York State.[8]

Indices were constructed for U.S. and New York State for the Census years identified above for all occupations, 99 SES categories, and the following occupational subcategories: (1) professionals, (2) managers, (3) clerical workers, (4) craftsmen, (5) operatives, (6) service workers, and (7) laborers. Changes in these measures over time are presented in Tables 3 and 4 and in Appendix A, pp.

Table 3

Total Labor Force -- Selected Index Values

	1940	1950	1960	1970
c' Index				
U.S. All[1]	0.51[2]	0.54	0.48	0.54
SES	0.58	0.60	0.53	0.58
N.Y. All	*	*	0.52	0.52
SES			0.58	0.54
C' Index				
U.S. All	0.68	0.70	0.65	0.73
SES	0.75	0.77	0.69	0.79
N.Y. All	*	*	0.72	0.75
SES			0.79	0.79

[1]All = overall individual occupations, SES = overall SES groups.

[2]Farm workers not included.

C' and c' (see table 3 above) for all U.S. occupations and for the 99 SES groups moved in the same directions: up slightly in 1950 from 1940, down in 1960, and up again in 1970 to a level higher than for any previous decade.

[8]The 99 Socioeconomic rankings (see page 5) had been tested for both 1950 and 1960 and found to have suitable stability for moving backward to 1940 and forward to 1970, for the U.S. data. Comparability, however, could be maintained only for 1960 and 1970 for New York State.

These movements undoubtedly reflect, respectively, the increased participation of women in more skilled (and better paid) occupations during World War II, their exodus from these ranks after the war was over,[9] and their return to the paid labor force in increasing numbers, but into lower occupational levels (primarily white-collar, however), during the 1960's.

There is little difference in the changing status of women as measured for "all occupations" and for the 99 "SES groups", suggesting the feasibility of drastically reducing data input by use of SES weighting when trend comparison is of concern. More significantly, both measures show remarkable, perhaps the word should be "deplorable", status stability over time, particularly in light of the growing participation of women in the paid labor force. As the French say "the more things change, the more they remain the same." ("Plus ca change, plus c'est le meme chose.")

Comparison for New York State can be made only for the 1960-1970 decade. Between April 1960 and April 1970, the number of employed women 14 years and older in the state increased by 22 percent; that for men only 2 percent.[10] During this same period the relative status of women as measured by C' over all occupations increased slightly from 0.72 to 0.75 while C' over all SES groups remained constant at 0.79. This contrasts with index changes for the U.S. where C' over all occupations increased from 0.65 to 0.73 and C' for SES groups increased from 0.69 to 0.79.

Comparison with the corresponding c' indices portrays the same situation. U.S. indices show increase in status for women; N.Y. indices show stable or decreasing status. These differences between New York and the United States may be attributed to the following factors:

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[9]Tobias, Sheila, "What Ever Happened to Rosie, the Riveter?," MSS, Vol. 1, No. 12 (June 1973).

[10]New York Business Fact Book, Part 2, New York State Department of Commerce, 1974.

(1) By 1970, manufacturing had been replaced by services as the topmost employer in the state. Besides services, New York State had larger shares than the United States, of employment in wholesale trade; finance, insurance and real estate; and in transportation, communications and public utilities. (Overall, women made up 39 percent of the State's labor force in 1970, a figure approximately the same as that for the country.)

(2) New York State employed women in 1970, filled about 70 percent of the clerical jobs, 44 percent of the service jobs (except in private households where the rate is much higher), and 39 percent of professional and technical positions.

The lack of significant changes in the New York indices shown in Table 3 can be explained by the interaction between factors 1 and 2. Although women are entering the labor force much faster, they are entering more lower SES ranked occupations in New York than in the U.S. Factor 1 defines the growth of service, clerical and sales-related jobs and Factor 2 defines the participation of women in these jobs. Since the indices used here are formed to give status relative to the proportion of females in the labor force, they will decrease if females entering the labor force go into low SES-ranked occupations.

Besides factors 1 and 2, the following is relevant to the contrast between New York and the U.S.:

(3) N.Y. women's "participation rate" in professional, technical, and kindred occupations, a wide-ranging category that employs almost one out of every six employed women (437,000) and has high SES rank dropped from 104 to 101, despite the fact that in April 1960 there was a 54 per increase in the total number of women in this category. Thus, in spite

of their increased employment, they were barely holding their own status-wise, as measured by the foregoing index.[11] Specific examples in professional, technical and kindred workers include the following:

(a) During the same period, female participation in noncollege teaching, which represented 40 percent of all professional women in 1970, fell from 204 to 171. Although their participation in college and university is rising slowly, by 1970 it had reached only 77.

(b) Another important group of women -- in the medical and health fields -- revealed trends meaningful for our analysis: participation rates among nurses and clinical laboratory technologists and technicians declined between 1960 and 1970. During the same period among physicians, dentists, and related practitioners, the female participation rate increased from 7% to 10%.[12]

In Appendix B, pp. 21-37 , are charts that graph the values the various indices take on for seven major occupational groupings. Below are a table and charts presenting the C' and C'" indices for major occupational groups in both New York and the United States.

The C' index measures status of women within each occupational grouping. Looking at charts below we see that the C' index behaves erratically for laborers, and craftsmen and foremen groups in the U.S. This may be due to the extremely low rate of participation of females in these occupational groups (less than ten percent for laborers and less than three percent for craftsmen and foremen in 1970) since any addition of new females to the work group could significantly effect

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[11] Later on we will note that U.S. women professionals fare even worse than New York women professionals. Thus this decline in professional participation does not aggravate the N.Y.-U.S. difference, it merely allows the previous two factors to work as they do.

[12] Op. Cit., Trends in Women's Occupations, pp. 1-5.

the status quo. Less erratic in their behavior, are the C' indices for Service Workers and Managers and Officials. The indices for the remaining three groups seem almost stable in comparison. We look at the behavior of the C' indices proceeding from most to least erratic.

Table 4

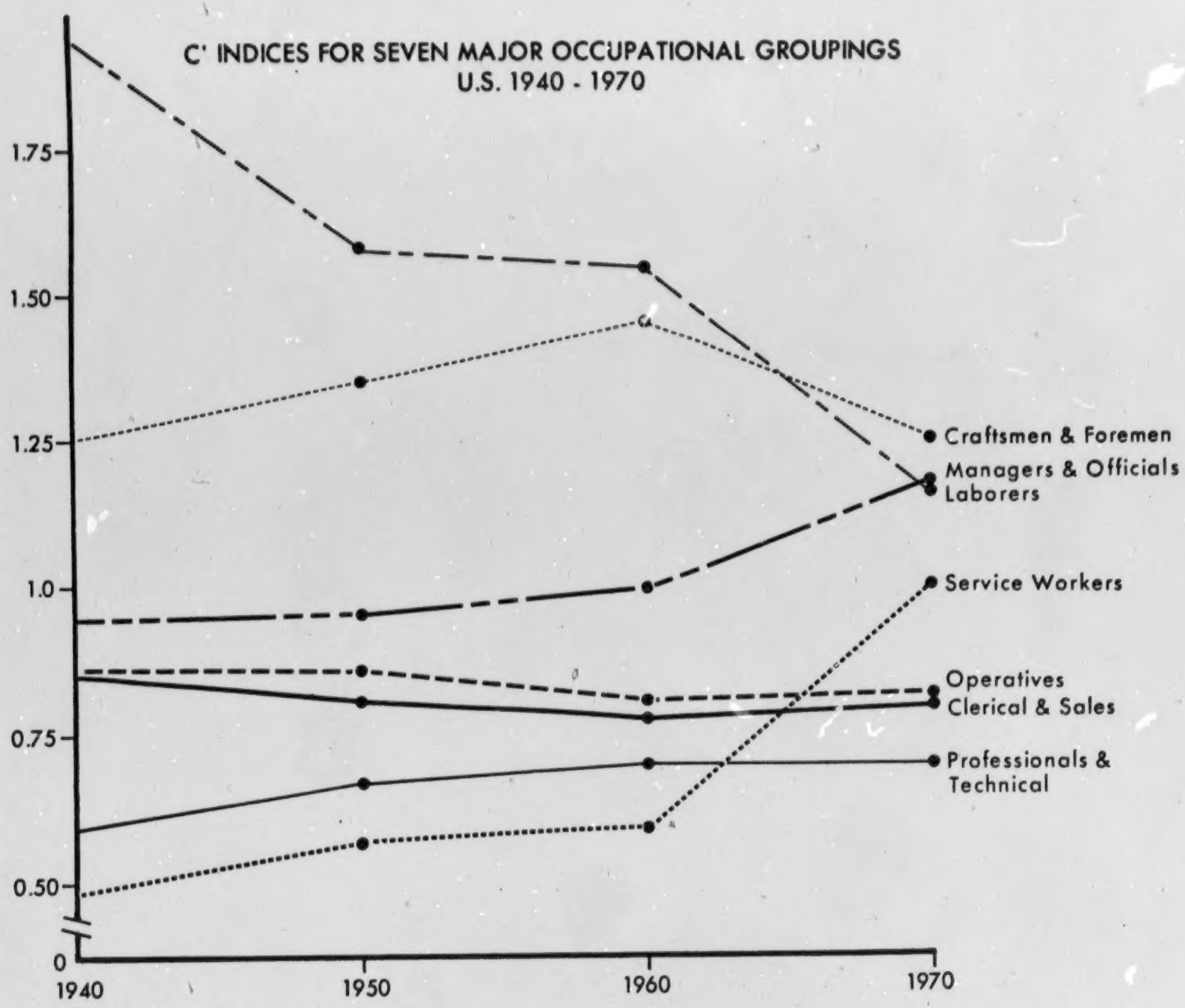
C' and C'" Measures of Female Occupational Mobility in Major Occupational Groups -- U.S. and New York

	C'				C'"			
U.S.	1940	1950	1960	1970	1940	1950	1960	1970
1[1]	0.59	0.67	0.70	0.70	1.05	0.99	0.83	0.72
2	0.94	0.96	1.00	1.18	0.29	0.33	0.33	0.37
3	0.85	0.81	0.77	0.80	1.61	1.99	1.98	2.21
4	1.25	1.35	1.46	1.25	0.07	0.10	0.08	0.10
5	0.86	0.86	0.81	0.82	0.72	0.71	0.59	0.57
6	0.48	0.57	0.59	1.01	1.89	1.74	1.92	2.42
7	1.94	1.58	1.55	1.16	0.14	0.14	0.11	0.15
N.Y.								
1	*[2]	*	0.74	0.74	*	*	0.76	0.79
2	*	*	1.11	1.15	*	*	0.35	0.37
3	*	*	0.84	0.89	*	*	1.91	1.93
4	*	*	0.96	0.93	*	*	0.06	0.07
5	*	*	0.70	0.73	*	*	0.68	0.59
6	*	*	0.87	1.11	*	*	1.59	1.72
7	*	*	1.27	1.12	*	*	0.15	0.14

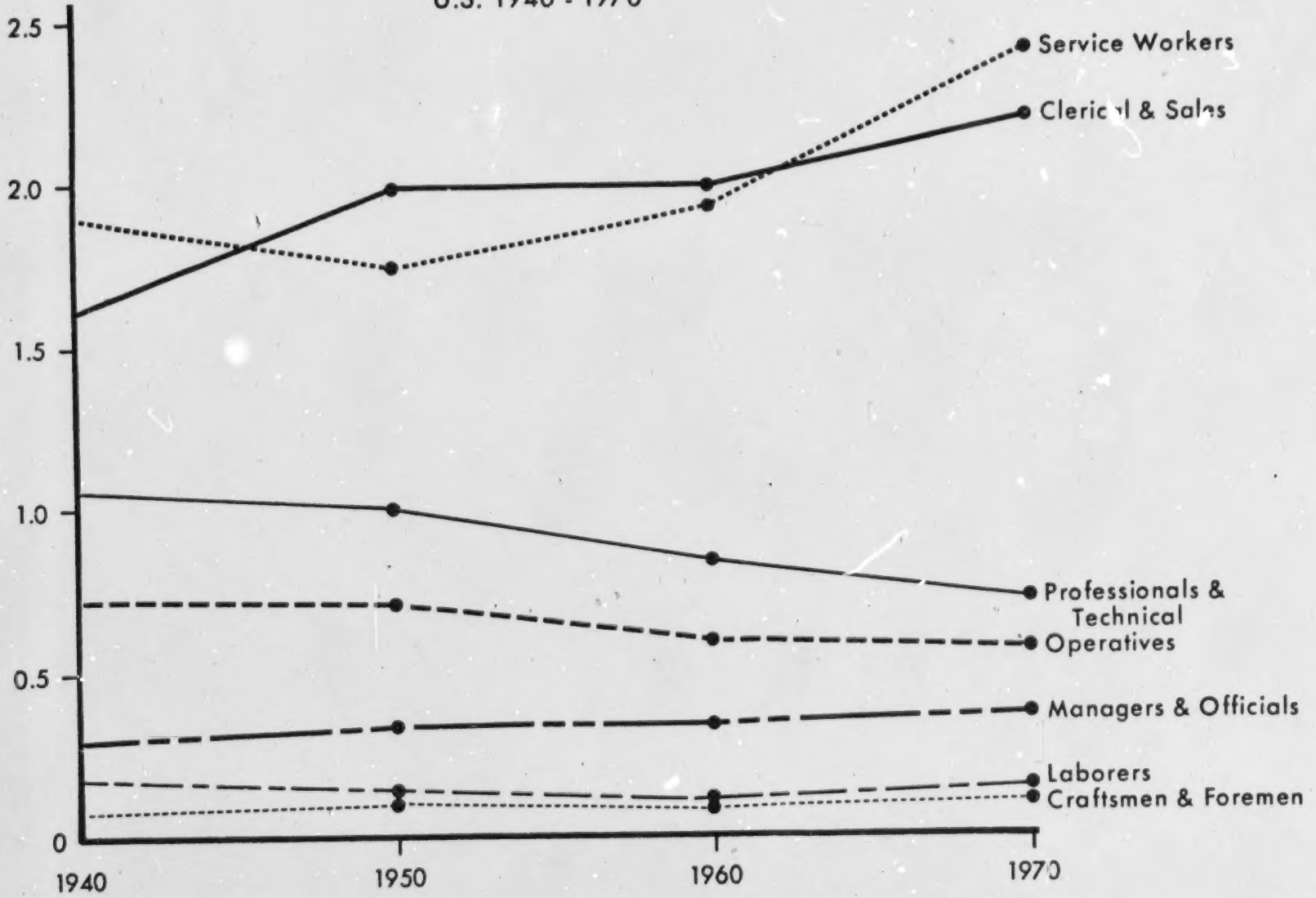
[1] 1 = Professional and technical, 2 = Managers and officials, 3 = Sales and clerical 4 = Craftsmen and foremen, 5 = Operatives, 6 = Service Workers, 7 = Laborers.

[2] No comparable data for New York.

Women's status among laborers seems to be declining steadily throughout the 1940-1970 time period with a sharp decline from 1940-1950, a slight one between 1950 and 1960, and again a sharp one between 1960 and 1970. Even so, it seems that among laborers, women are still better off than men (as of 1970) with a C' index value of 1.16. The New York index also shows a decline but not quite so sharp as for the U.S. The status of women among laborers was lower in-


C' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
U.S. 1940 - 1970
1.75
1.50
1.25
1.0
0.75
0.50
0
1940
1950
1960
1970
Craftsmen & Foremen
Managers & Officials
Laborers
Service Workers
Operatives
Clerical & Sales
Professionals &
Technical

C''' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
U.S. 1940 - 1970



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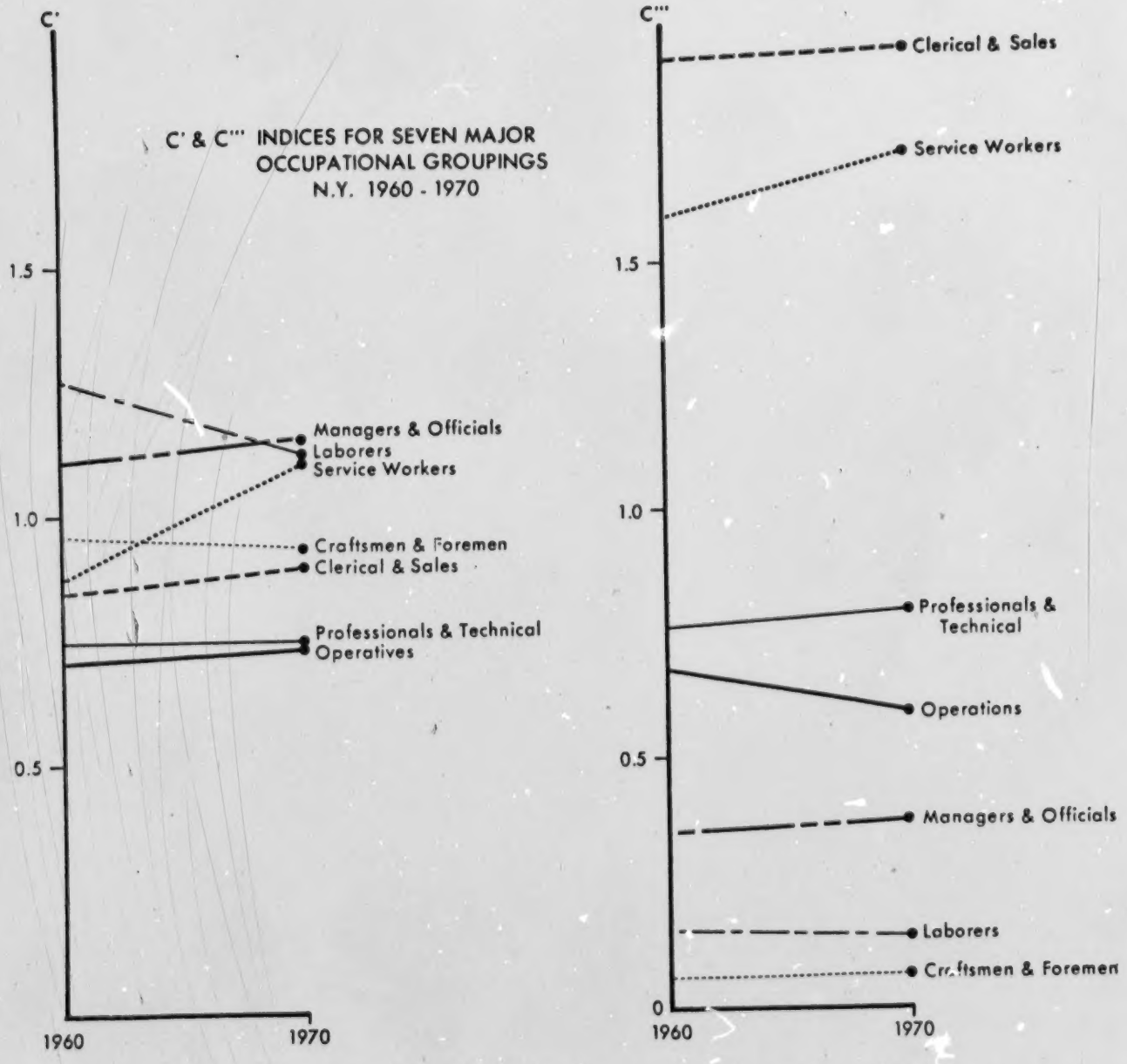

C' & C''' INDICES FOR SEVEN MAJOR
OCCUPATIONAL GROUPINGS
N.Y. 1960 - 1970
C'
1.5
1.0
0.5
1960
1970
Managers & Officials
Laborers
Service Workers
Craftsmen & Foremen
Clerical & Sales
Professionals & Technical
Operatives
C'''
1.5
1.0
0.5
0
1960
1970
Clerical & Sales
Service Workers
Professionals & Technical
Operations
Managers & Officials
Laborers
Craftsmen & Foremen

New York at 1.12 but this may be because New York C' index for laborers is closer to the end of the steady decline of women's status among laborers than we witness for the U.S.

This high (though declining) status of females among laborers has little significance when one considers the small percentage of women in laborer occupations or the status of women laborers, relative to the proportion of women in the labor force. The C'" index for laborers in the U.S. shows the almost hopelessly low status of women in this group relative to participation in the total labor force. Women's laborer status as measured by C'" in the U.S. remained almost steady throughout 1940-1960 -- dropping slightly in 1950-1960 and reaching a new "low-high" of 0.15 in 1970. In New York the status of women laborers as measured by C'" is almost the same for the U.S.decreasing in 1960-1970 from 0.15 to 0.14.

Going back to the C' index we look at the peculiar behavior of the index for the craftsmen and foremen group. There is a steady increase in status of women among craftsmen and foremen throughout 1940-1960. However in 1960-1970 there is a complete reversal in trend with the C' index going back to its 1940 value of 1.25. The New York index shows a similar, though not so sharp, decline for the 1960-1970 period from 0.96 to 0.93, both far below the status of women for that group in the U.S.

Again we may note that the erratic behavior of this index, as in the case of laborers, becomes less significant when the extremely low participation rate of women in the craftsmen and foremen group is considered. The C'" index of women's status in the craftsmen and foremen group relative to their participation in the labor force has been almost stable through 1940-1970 reaching a "low-high" for this period of 0.10. The C'" index at 0.06 and 0.07 for New York was even more stable (almost static) between 1960 and 1970.

U.S. women's status among service workers has been improving steadily throughout 1940-1970 with a sharp increase in C' to 1.01 in 1960-1970. The New York index showed a similar sharp increase in 1960-1970 taking on a value of 1.11. The C'" index of women's status in service workers relative to their participation in the total work force behaves somewhat erratically throughout 1940-1970. C'" declines in 1940-1950, increases in 1950-1960, and increases sharply in 1960-1970 to 2.42. The C'" index for service workers in New York behaves in similar fashion to the U.S. index in 1960-1970 but reaches a lower level of 1.72. Given the increasing and high values of both the C' and C'" indices we may conclude that women are entering higher SES-ranked service occupations.

U.S. women among managers and officials have shown a continuous improvement in their status with sharp improvement in 1960-1970 to a C' value of 1.18. New York women do not show such a sharp improvement but are on par in standing with U.S. women with a C' value of 1.15 in 1970. However, U.S. women's status relative to female-participation in the total work force remains low for this group. The C'" index for U.S. has remained almost stable throughout the 1940-1970 period showing slight improvement to 0.37 in 1970. The New York index behavior for 1960-1970 is almost the same as the U.S., the New York C'" of women's work status in managers and officials relative to total work force participation reaching 0.37 in 1970. Although women are improving their status among managers and officials, their increased participation in the group is not enough to outweigh the increased participation of women in the total labor force.

The remaining three C' indices for the U.S. are stable and near static throughout 1940-1970. Women among professionals and technical workers improved their status at a decelerating rate through 1940-1970 with C' reaching

a value of 0.70 in 1960 and remaining there through 1970. The C'" index for professional and technical workers group relative to female participation in the total work force declined throughout 1940-1970, from 1.05 to 0.72. In contrast to this U.S. pattern, the New York index shows a slight increase in 1960-1970 reaching 0.79 from 0.76. Although the status of U.S. women among professional and technical workers has improved somewhat, this improvement was not enough to make up for the slow increases of occupations relative to total labor force participation rates.

Status of women among clerical and sales workers has been somewhat stable, declining in 1940-1960 and improving slightly in 1960-1970 at which point C' takes on the value 0.80. The status of women among this group is slightly higher in New York with C' moving up to 0.89 in 1970. The C'" index for clerical and sales workers is less stable and similar to that index for service workers. The participation of women in sales and clerical work is higher than their participation in the total labor force. Status of women relative to participation in the total labor force has been increasing with C'" reaching a value of 2.21. New York also shows a high value of 1.93 in 1970. Women seem to be entering sales and clerical jobs at the same low ranked occupations as they have all along (C' has not changed much) though their participation in sheer numbers has greatly increased.

The U.S. C' index for operatives behaves much like the index for clerical and sales workers with C' equal to 0.82 in 1970. The New York index shows the same slow growth between 1960 and 1970 as the U.S. index but at lower values (C' for New York in 1970 is equal to 0.73). Looking, however, at the C'" for operatives in the U.S. one finds no resemblance in behavior to the

clerical and sales index. The status of U.S. female operatives relative to participation in the work force is low and slowly decreasing throughout 1940-1970 reaching 0.57 in 1970. The New York C'" index for operatives shows a decrease in 1960-1970 from 0.68 to 0.57. Among operatives, U.S. and New York State, women seem to be losing ground.

This concludes the summary of status-index behavior. The 1960-1970 period seems to be a changing decade for women's status within occupational groups as evidenced by the rather drastic changes in four of the seven C' indices. Indices for New York did not parallel those for U.S., and we cannot see as well if big changes are taking place. However over the 1960-1970 period we can compare the slopes of C' for the various occupations and note that most slopes for C' in New York occupations are all less in magnitude than those for the U.S.

Status of women in occupations with respect to total labor force participation as measured by C'" is much more stable than for status within groups. Women's position in sales, clerical, and service is getting better where as status of women in laborers and in craftsmen and foremen (traditionally very male occupations) relative to participation in the total labor force, remains low.

Status of U.S. as measured by C'" women in operatives has declined and in managers has increased slightly, and in professional and technical occupations has declined. Quite disturbing is the performance of C'" index for the professional and technical workers where women faired well in 1940 but lost out in 1950-1970. (The index dropped from 0.99 in 1950 to 0.72 in 1970). Perhaps schools are not admitting as many qualified females as would be fair. Perhaps women do not enroll in certain fields in proportion to total school enrollment. More

likely it is some combination of these factors plus the family responsibility factor plus discrimination that is allowing women's status in the professional and technical groupings relative to participation in the total labor force to decline, and conversely causing the status of women in service, sales, and clerical groups, relative to total labor force participation, to improve.

By contrast, the status of New York State women during the 1960's in these same seven categories was relatively unchanged except for the increase in C' for service workers from 0.87 to 1.11 and the decline in C"' for operatives from 0.68 to 0.59.

Keeping in mind that our indices assume parity, or 1, as an ideal goal and that we have prepared a variety of measures but recommend C' (one that evaluates the changing status of women relative to that of men but adjusts for group size), we may conclude that:

(1) U.S. female status in 1970 was 0.73 percent of male status in 1970, up from 0.68 percent in 1940, when all occupations are indexed.

(2) These figures increase to 0.79 and 0.75 percent, respectively, when the 500+ occupations are squeezed into 99 SES categories, indicating that the procedure is viable for a social-indicator approach to female occupational-status mobility.

(3) For New York State, for the period 1960-1970, movement was in the same direction for all occupations, up from 0.72 to 0.75 percent, but female status relative to males remained unchanged by SES categories at 0.79 percent. See discussion on page 15 above.

(4) Unadjusted for group size, the c' index for the U.S. moved in essentially the same direction for both sets of occupations (up in 1950, down in 1960, and up in 1970), but at substantial lower levels of parity.

(5) Unadjusted for group size, the c' index for New York State is unchanged for "all occupations" at 0.52 percent of parity, but drops from 0.58 to 0.54 percent for SES categories.

And remembering the old adage "figures don't lie, statisticians figure," the consumer, male or female, must choose which figure to use to illustrate how good or bad female occupational status is and whether or not that status is improving.

Appendix A

Twelve Measures of Female/Male Occupational Mobility:

United States 1940 - 1970 New York 1960 - 1970[1]

		a'	a"'[3]	b'	b"'	c'	c"'	a'	a"'	b'	b"'	c'	c"'
		1940						1950					
U.S.	All	0.59[4]	0.59	1.16	1.16	0.51	0.51	0.63	0.63	1.17	1.17	0.54	0.54
	SES	0.65	0.65	1.14	1.14	0.58	0.58	0.68	0.68	1.14	1.14	0.60	0.60
U.S.	1	0.56	0.82	1.31	1.06	0.43	0.77	0.66	0.85	1.23	1.08	0.54	0.79
	2	0.97	0.37	1.00	1.23	0.96	0.30	0.99	0.43	1.00	1.26	0.99	0.34
	3	0.68	1.02	1.25	0.99	0.54	1.03	0.65	1.11	1.38	0.96	0.47	1.16
	4	1.52	0.12	0.99	1.30	1.54	0.09	1.66	0.17	0.98	1.42	1.70	0.12
	5	0.78	0.69	1.07	1.11	0.73	0.62	0.80	0.70	1.07	1.13	0.75	0.62
	6	0.52	1.12	1.75	0.95	0.30	1.18	0.60	1.12	1.57	0.94	0.39	1.19
	7	2.58	0.24	0.96	1.26	2.70	0.19	2.07	0.25	0.96	1.32	2.16	0.19
N.Y.[2]		****	****	****	****	****	****	****	****	****	****	****	****
		1960						1970					
U.S.	All	0.59	0.59	1.21	1.21	0.48	0.48	0.66	0.66	1.22	1.22	0.54	0.54
	SES	0.63	0.63	1.19	1.19	0.53	0.53	0.69	0.69	1.19	1.19	0.58	0.58
U.S.	1	0.68	0.77	1.19	1.13	0.57	0.68	0.68	0.70	1.21	1.19	0.56	0.59
	2	1.01	0.43	1.00	1.30	1.01	0.33	1.22	0.52	0.96	1.33	1.28	0.39
	3	0.71	1.19	1.38	0.91	0.51	1.31	0.80	1.31	1.35	0.80	0.60	1.64
	4	1.79	0.15	0.98	1.50	1.83	0.10	1.50	0.19	0.97	1.58	1.54	0.12
	5	0.75	0.60	1.09	1.20	0.69	0.50	0.79	0.63	1.09	1.26	0.73	0.50
	6	0.73	1.35	1.45	0.82	0.50	1.65	0.98	1.52	1.03	0.67	0.96	2.28
	7	1.97	0.20	0.96	1.33	2.04	0.15	1.09	0.22	0.99	1.47	1.10	0.15
N.Y.	All	0.62	0.62	1.20	1.20	0.52	0.52	0.63	0.63	1.22	1.22	0.52	0.52
	SES	0.67	0.67	1.17	1.17	0.58	0.58	0.66	0.66	1.21	1.21	0.54	0.54
N.Y.	1	0.73	0.74	1.15	1.14	0.63	0.65	0.72	0.75	1.18	1.15	0.62	0.66
	2	1.28	0.53	0.95	1.[illegible]	1.34	0.42	1.20	0.52	0.96	1.28	1.25	0.41
	3	0.78	1.22	1.27	0.8[illegible]	0.61	1.39	0.86	1.30	1.18	0.83	0.73	1.57
	4	0.83	0.08	1.01	1.49	0.83	0.05	0.76	0.09	1.01	1.54	0.75	0.06
	5	0.65	0.64	1.18	1.19	0.55	0.54	0.64	0.55	1.17	1.26	0.54	0.44
	6	0.93	1.33	1.07	0.82	0.87	1.62	1.09	1.42	0.91	0.75	1.20	1.88
	7	1.30	0.22	0.98	1.42	1.32	0.15	1.14	0.21	0.99	1.47	1.16	0.14

[1] Key to subheadings for U.S. and N.Y.: All = overall individual occupations, SES = overall groups of occupations -- grouping by SES score, 1 = professional and technical, 2 = managers and officials, 3 = clerical and sales, 4 = craftsmen and foremen, 5 = operatives, 6 = service workers, 7 = laborers.

[2] Comparable date not available.

[3] Formulae of a' and a"', b' and b"', and c' and c"' yield identical results when taken over all of labor force.

[4] Farm workers are not included in the occupations from which any of the indices are computed.

Twelve Measures of Female/Male Occupational Mobility:

United States 1940 - 1970 New York 1960 - 1970[1]

		A'	A"'[3]	B'	B"'	C'	C"'	A'	A"'	B'	B"'	C'	C"'
		1940						1950					
U.S.	All	0.75[4]	0.75	1.10	1.10	0.68	0.68	0.77	0.77	1.10	1.10	0.70	0.70
	SES	0.80	0.80	1.08	1.08	0.75	0.75	0.83	0.83	1.07	1.07	0.77	0.77
U.S.	1	0.71	1.04	1.20	0.99	0.59	1.05	0.77	1.00	1.15	0.99	0.67	0.99
	2	0.94	0.36	1.01	1.26	0.94	0.29	0.97	0.42	1.01	1.26	0.96	0.33
	3	0.91	1.37	1.07	0.85	0.85	1.61	.90	1.53	1.11	0.77	0.81	1.99
	4	1.24	0.10	0.99	1.36	1.25	0.07	1.33	0.13	0.99	1.38	1.35	0.10
	5	0.89	0.79	1.04	1.09	0.86	0.72	0.90	0.78	1.04	1.10	0.86	0.71
	6	0.70	1.51	1.46	0.80	0.48	1.89	0.76	1.42	1.32	0.82	0.57	1.74
	7	1.89	0.18	0.98	1.33	1.94	0.14	1.54	0.19	0.98	1.36	1.58	0.14
N.Y.[2]		****	****	****	****	****	****	****	****	****	****	****	****
		1960						1970					
U.S.	All	0.74	0.74	1.13	1.13	0.65	0.65	0.82	0.82	1.12	1.12	0.73	0.73
	SES	0.77	0.77	1.12	1.12	0.69	0.69	0.86	0.86	1.08	1.08	0.79	0.79
U.S.	1	0.79	0.88	1.13	1.06	0.70	0.83	0.79	0.81	1.14	1.12	0.70	0.72
	2	1.00	0.42	1.00	1.30	1.00	0.33	1.15	0.49	0.97	1.33	1.18	0.37
	3	0.89	1.48	1.15	0.75	0.77	1.98	0.92	1.50	1.15	0.68	0.80	2.21
	4	1.44	0.12	0.99	1.46	1.46	0.08	1.24	0.15	0.99	1.54	1.25	0.10
	5	0.86	0.69	1.05	1.16	0.81	0.59	0.87	0.68	1.06	1.20	0.82	0.57
	6	0.79	1.46	1.35	0.76	0.59	1.92	1.01	1.55	0.99	0.64	1.01	2.42
	7	1.52	0.16	0.98	1.43	1.55	0.11	1.14	0.23	0.99	1.49	1.16	0.15
N.Y.	All	0.80	0.80	1.11	1.11	0.72	0.72	0.83	0.83	1.10	1.10	0.75	0.75
	SES	0.85	0.85	1.08	1.08	0.79	0.79	0.86	0.86	1.09	1.09	0.79	0.79
N.Y.	1	0.82	0.83	1.10	1.09	0.74	0.76	0.82	0.85	1.11	1.09	0.74	0.79
	2	1.10	0.45	0.98	1.29	1.11	0.35	1.12	0.49	0.98	1.30	1.15	0.37
	3	0.92	1.45	1.10	0.76	0.84	1.91	0.95	1.43	1.07	0.74	0.89	1.93
	4	0.96	0.09	1.00	1.49	0.96	0.06	0.93	0.11	.00	1.52	0.93	0.07
	5	0.78	0.76	1.11	1.13	0.70	0.68	0.80	0.69	..0	1.18	0.73	0.59
	6	0.93	1.32	1.07	0.83	0.87	1.59	1.05	1.36	0.95	0.79	1.11	1.72
	7	1.25	0.21	0.99	1.42	1.27	0.15	1.11	0.20	0.99	1.47	1.12	0.14

[1] Key to subheadings for U.S. and N.Y.: All = overall individual occupations, SES = overall groups of occupations -- grouping by SES score, 1 = professional and technical, 2 = managers and officials, 3 = clerical and sales, 4 = craftsmen and foremen, 5 = operatives, 6 = service workers, 7 = laborers.

[2] Comparable data not available

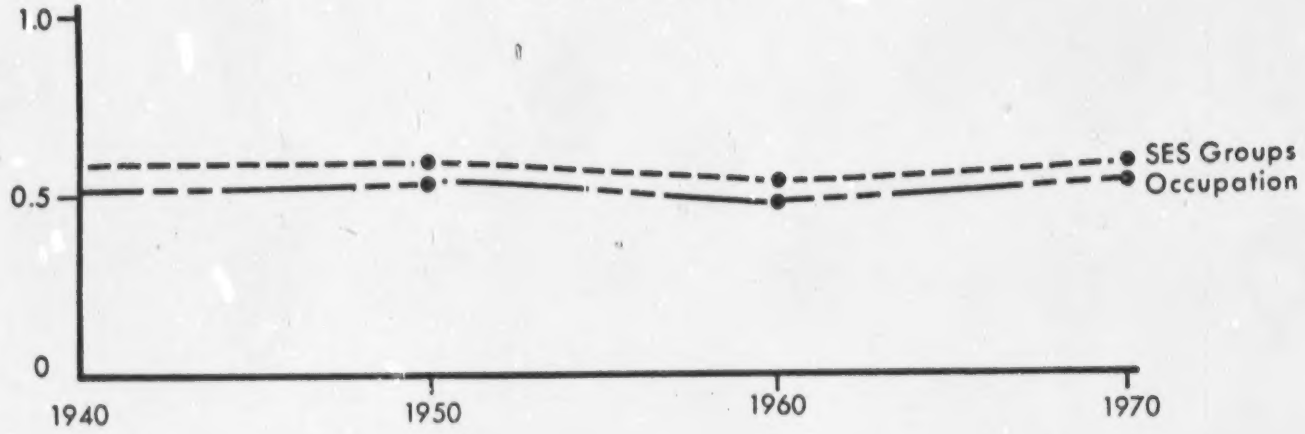
[3] Formula for A' and A"', B' and B"' and C' and C"' yield identical results when taken over all of labor force.

[4] Farm workers are not included in the occupations from which any of the indices are computed.

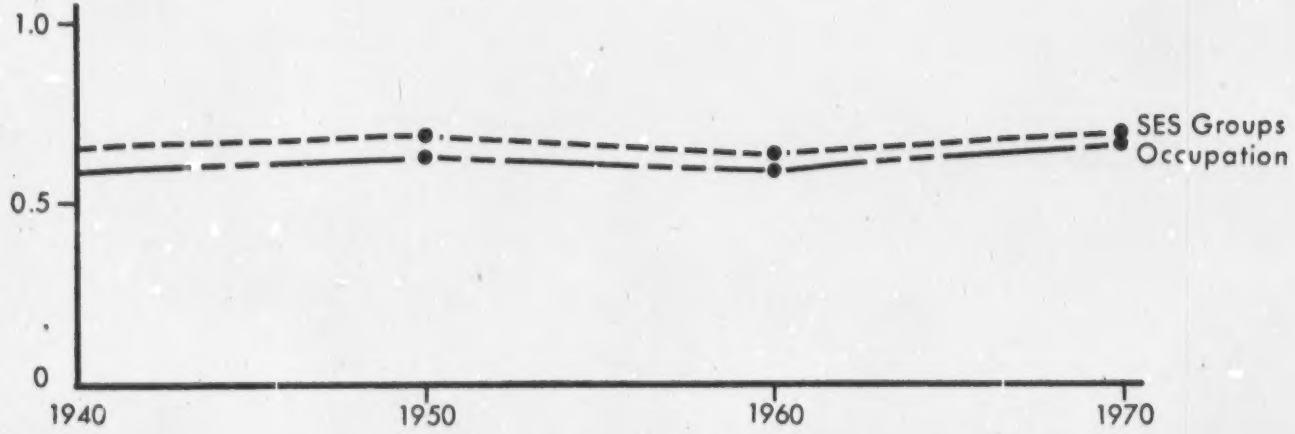
Appendix B

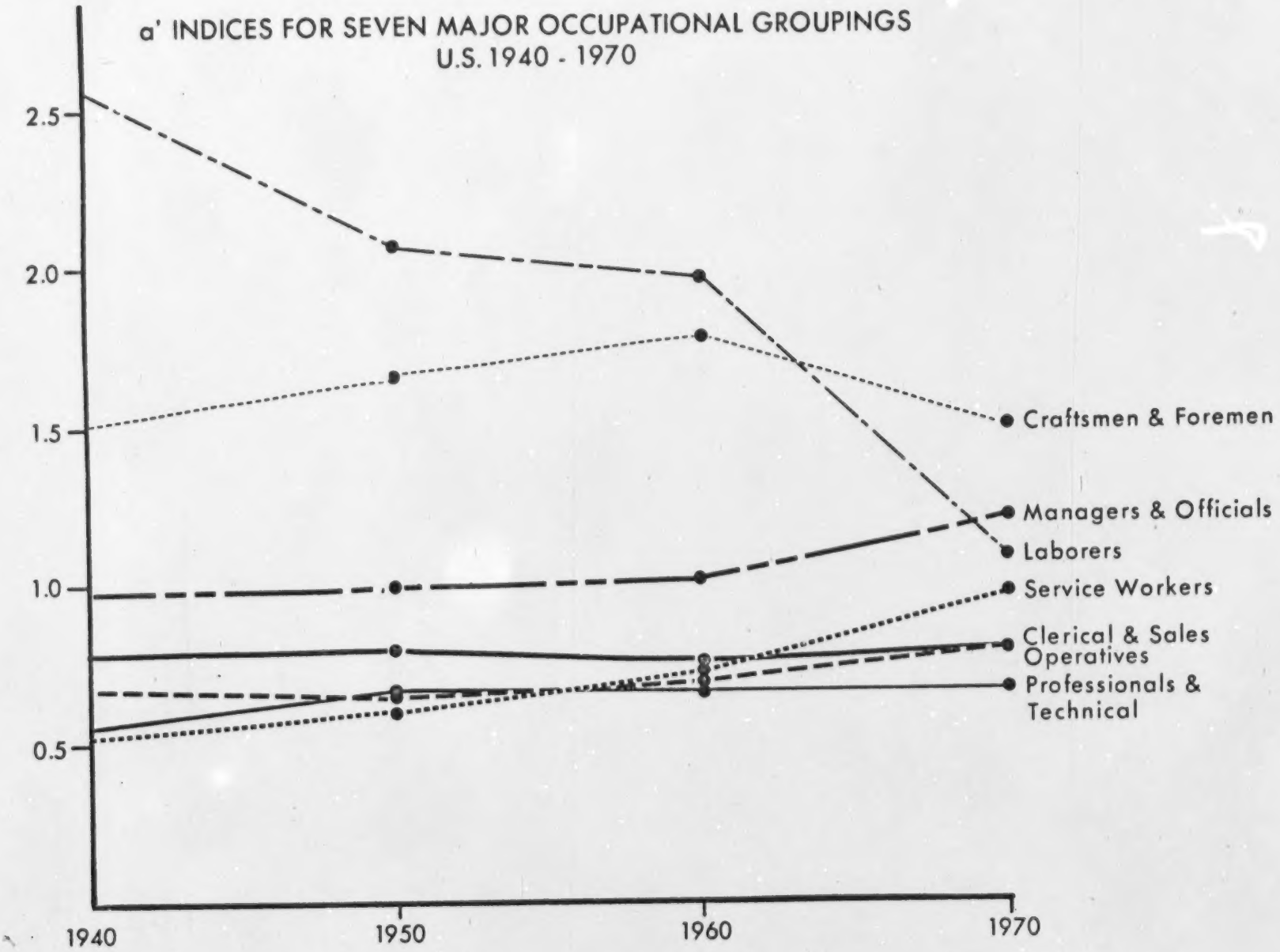
Graphical Presentation of Indices

c' INDICES FOR TOTAL LABOR FORCE
U.S. 1940 - 1970

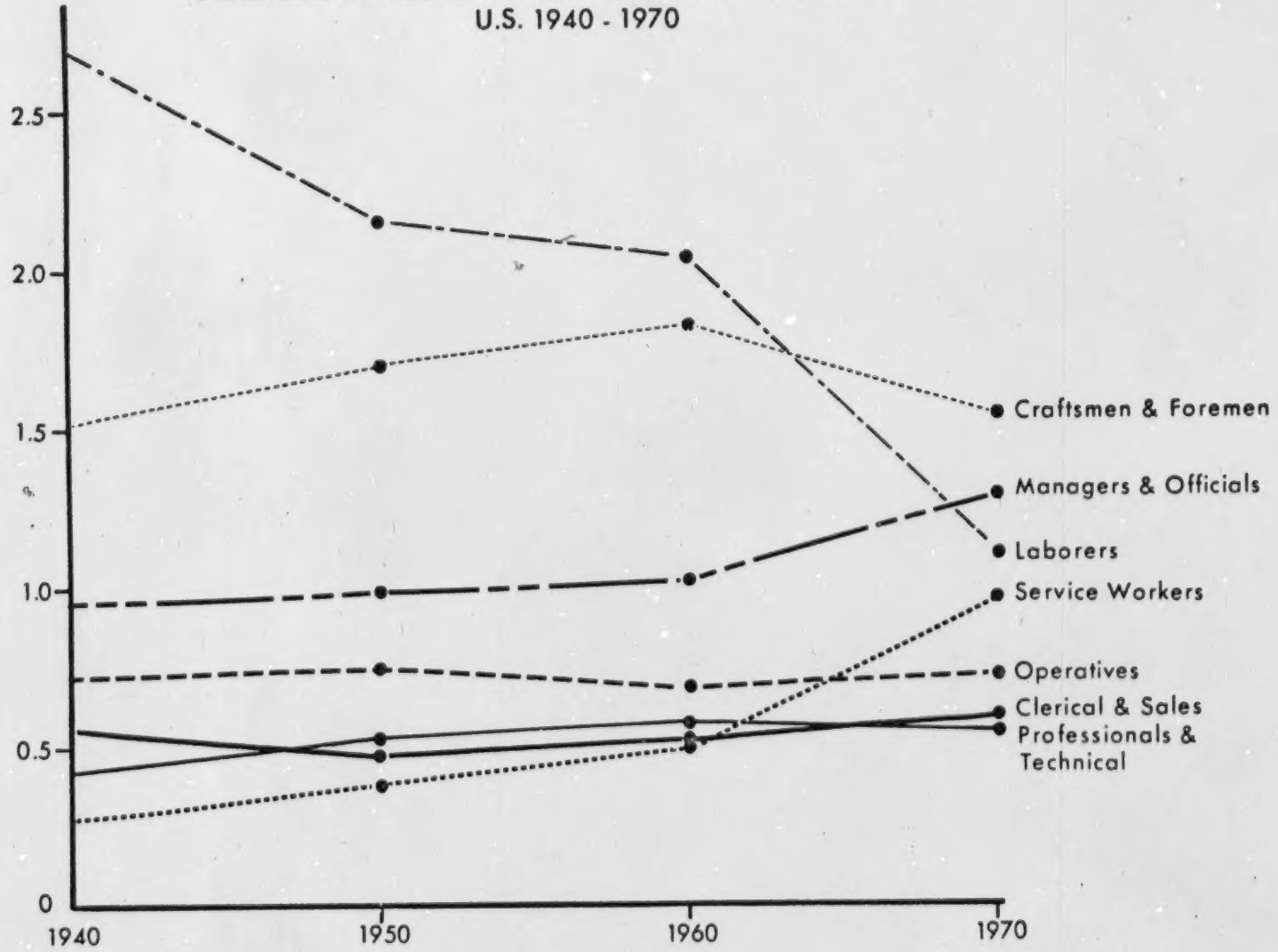


a' INDICES FOR TOTAL LABOR FORCE
U.S. 1940 - 1970




a' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
U.S. 1940 - 1970
2.5
2.0
1.5
1.0
0.5
1940
1950
1960
1970
Craftsmen & Foremen
Managers & Officials
Laborers
Service Workers
Clerical & Sales Operatives
Professionals & Technical

c' INDICIES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
U.S. 1940 - 1970



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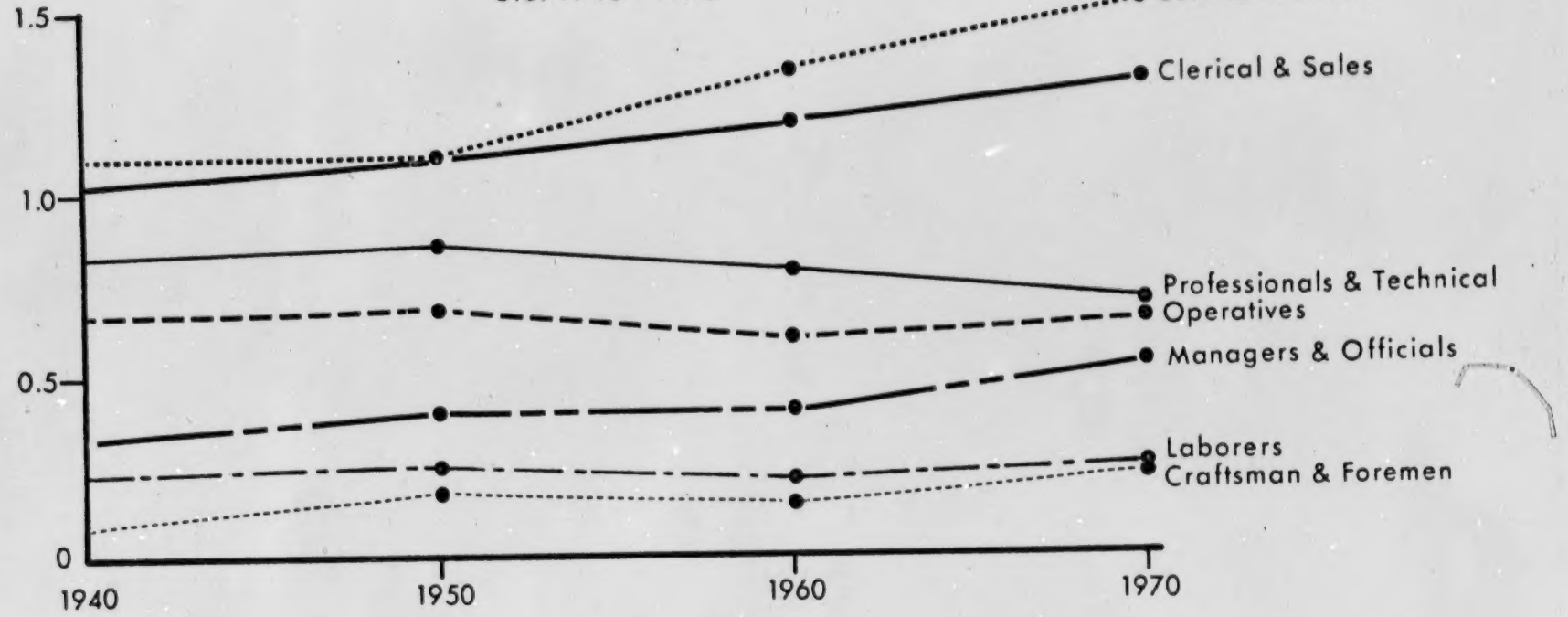
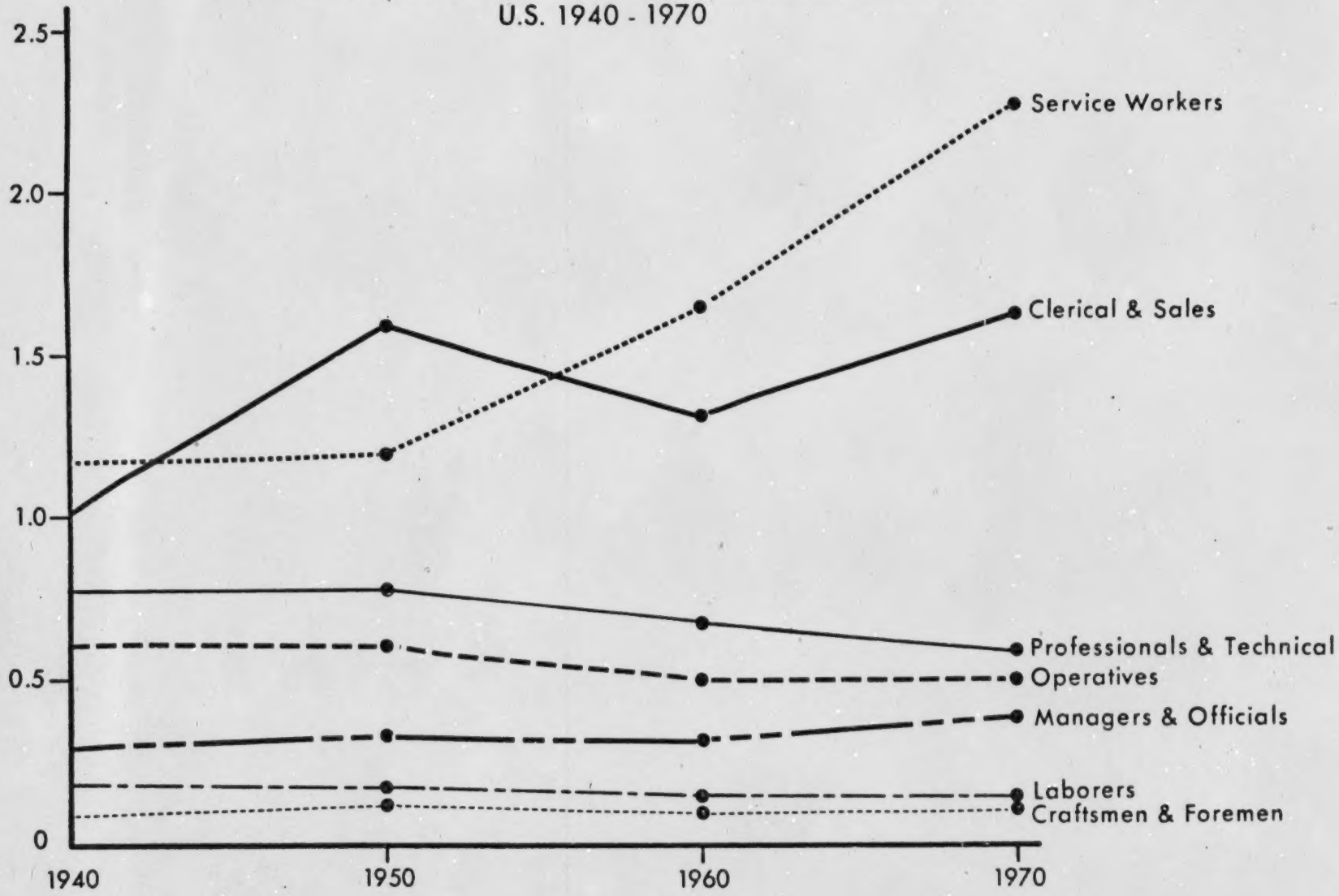
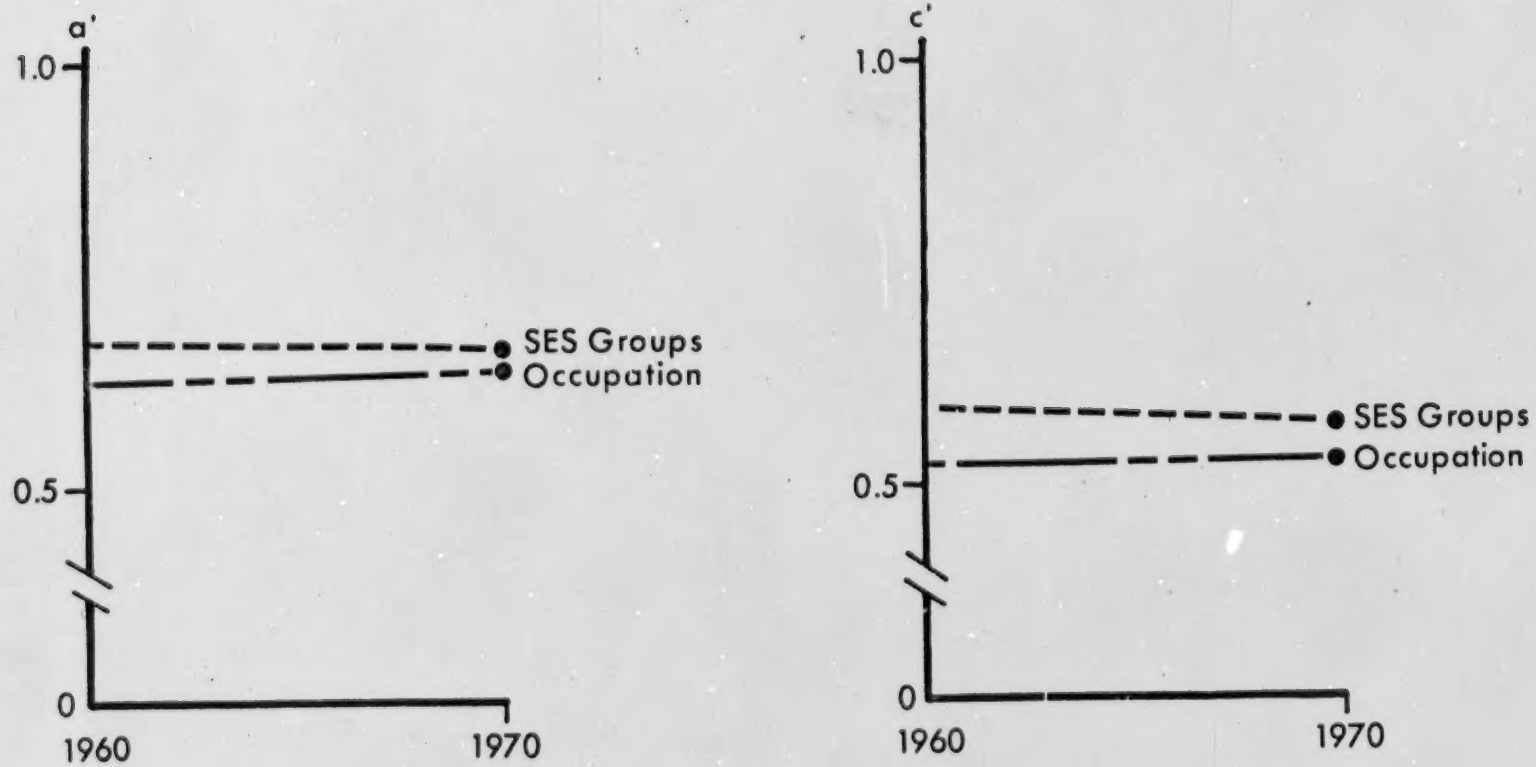
U.S. 1940 - 1970



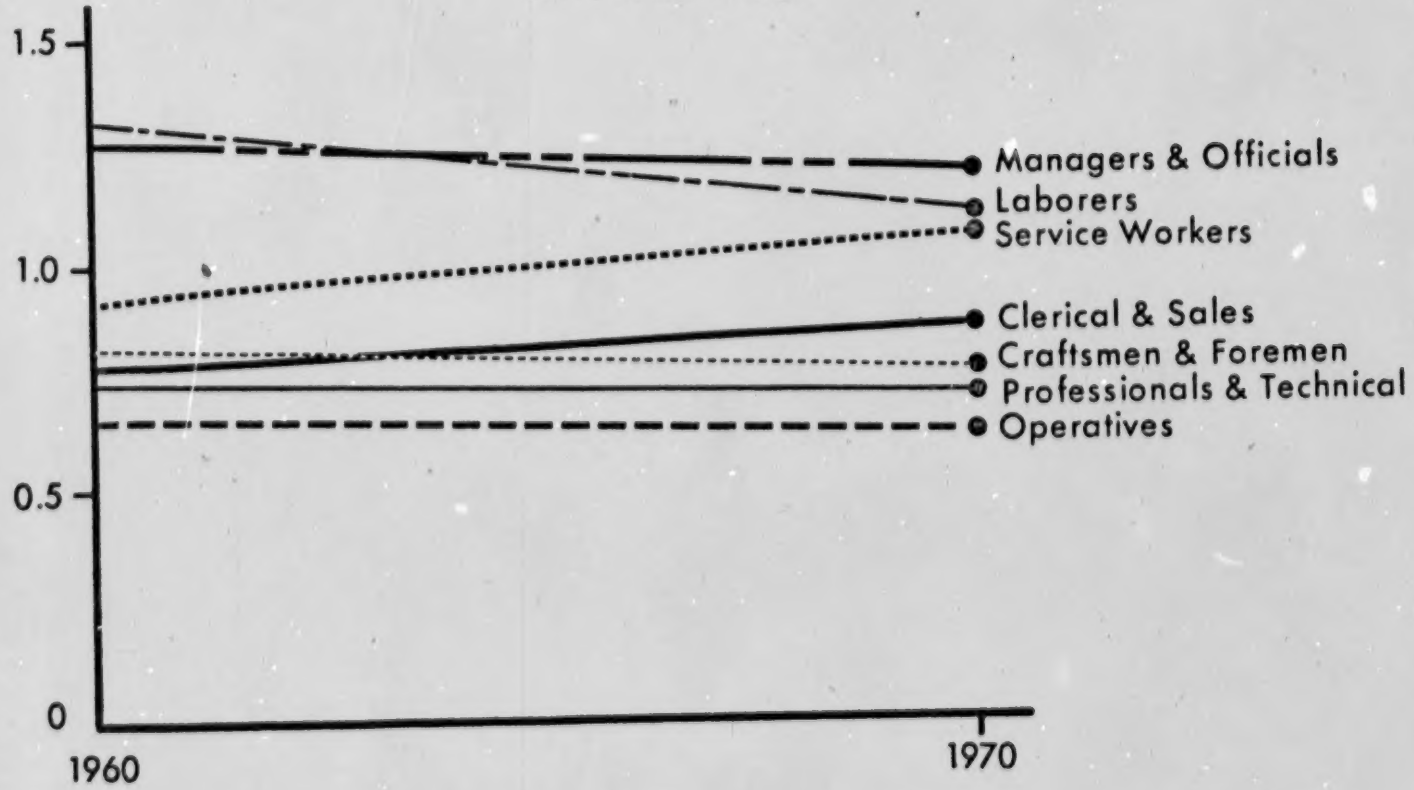
c''' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
U.S. 1940 - 1970

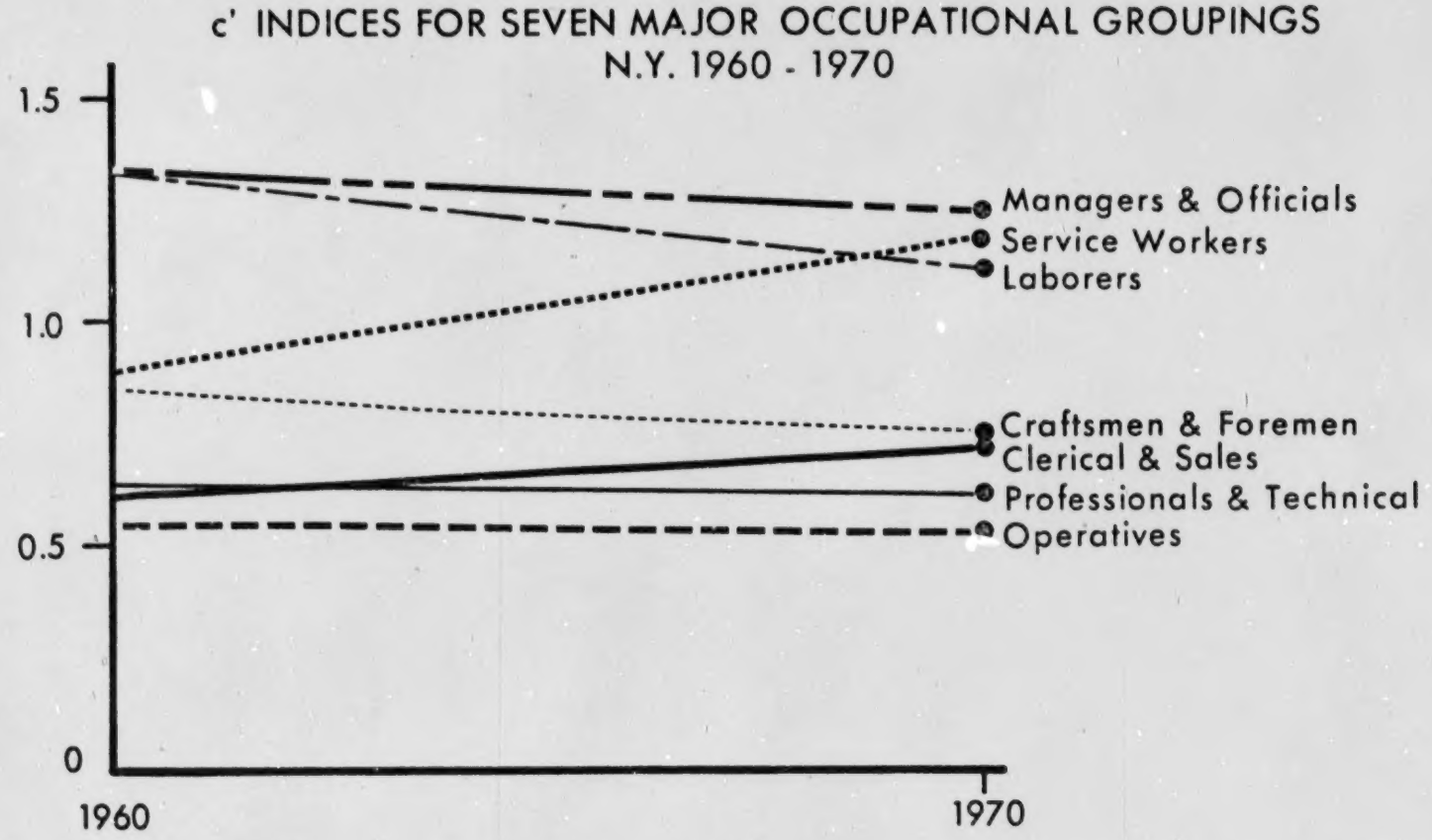


a' & c' INDICES FOR TOTAL LABOR FORCE
N.Y. 1960 - 1970

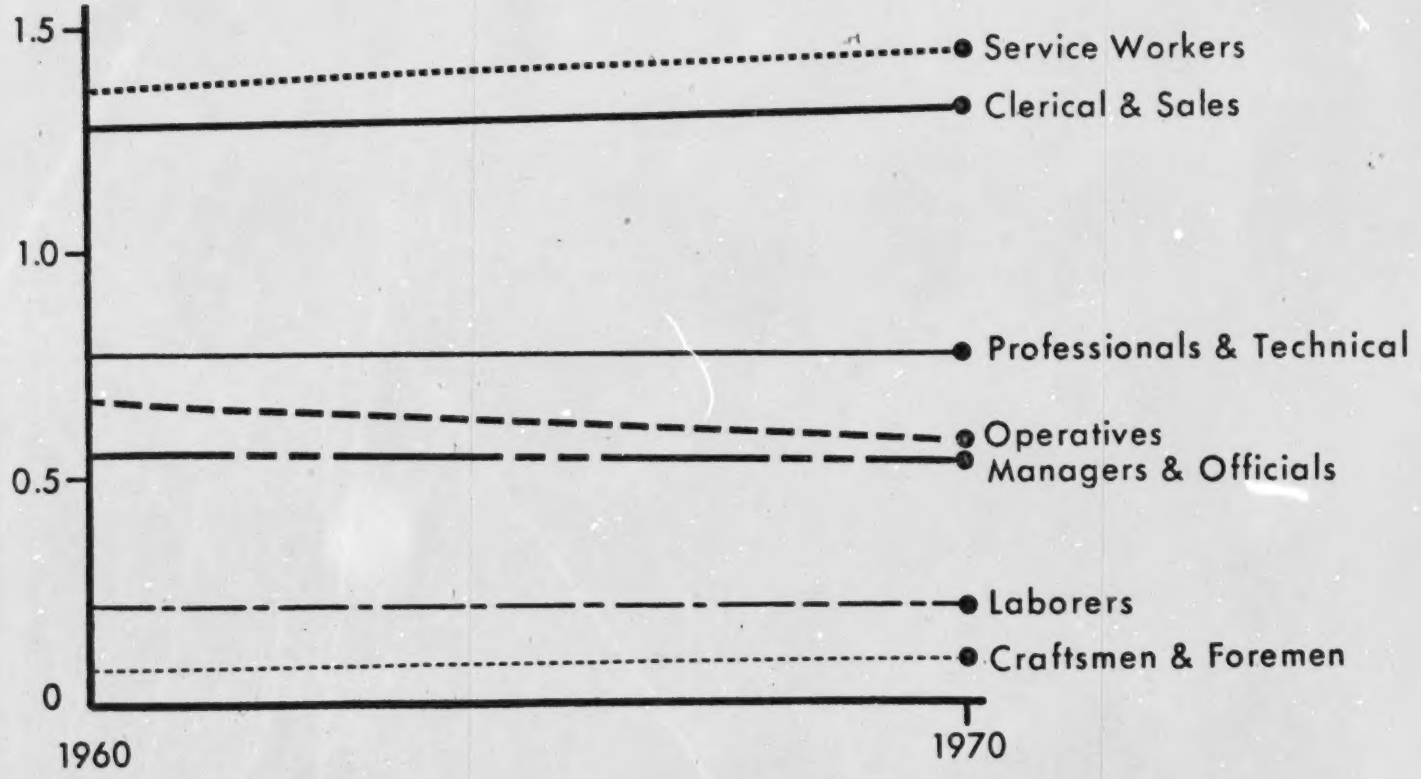


a' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
N.Y. 1960 - 1970

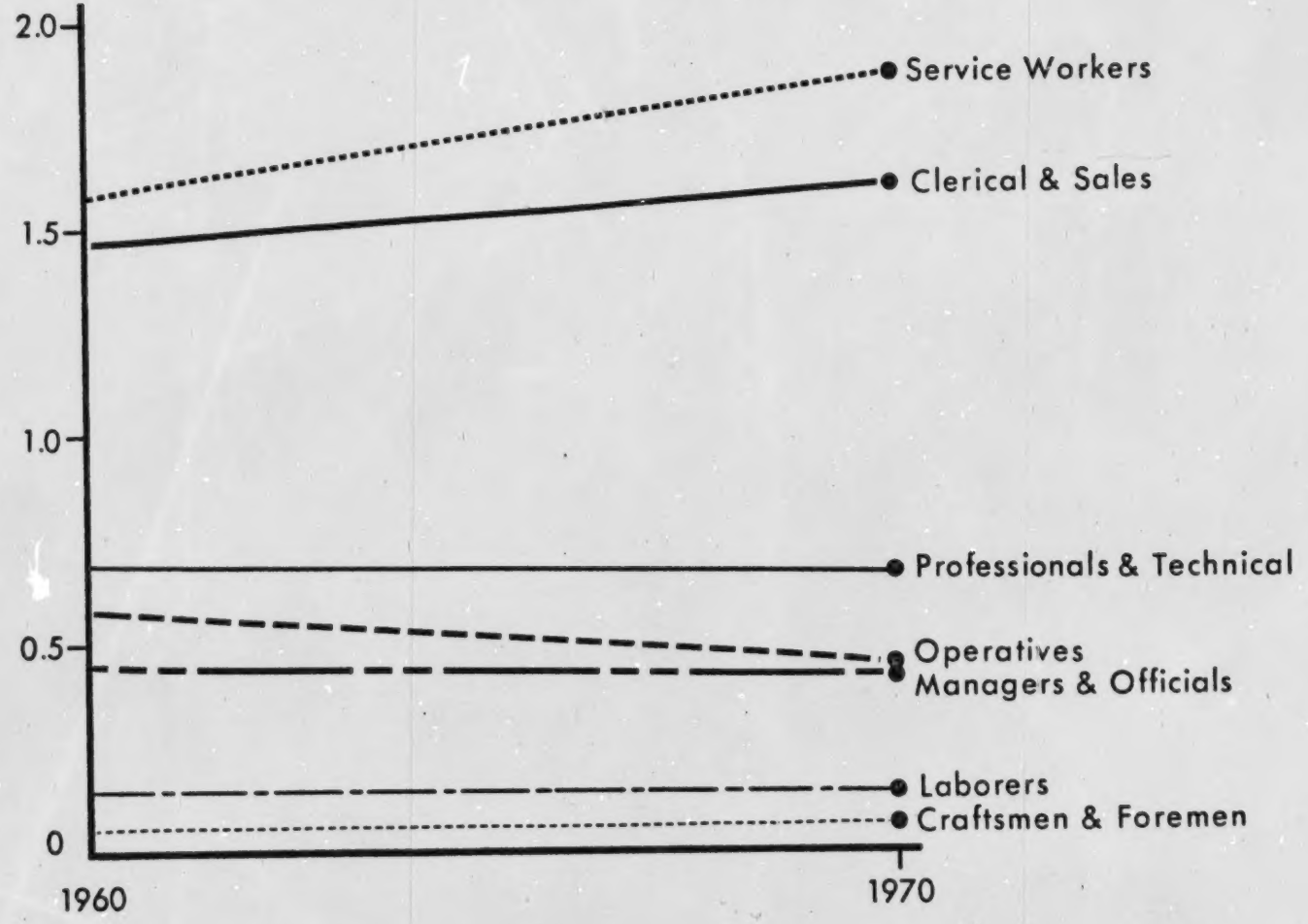


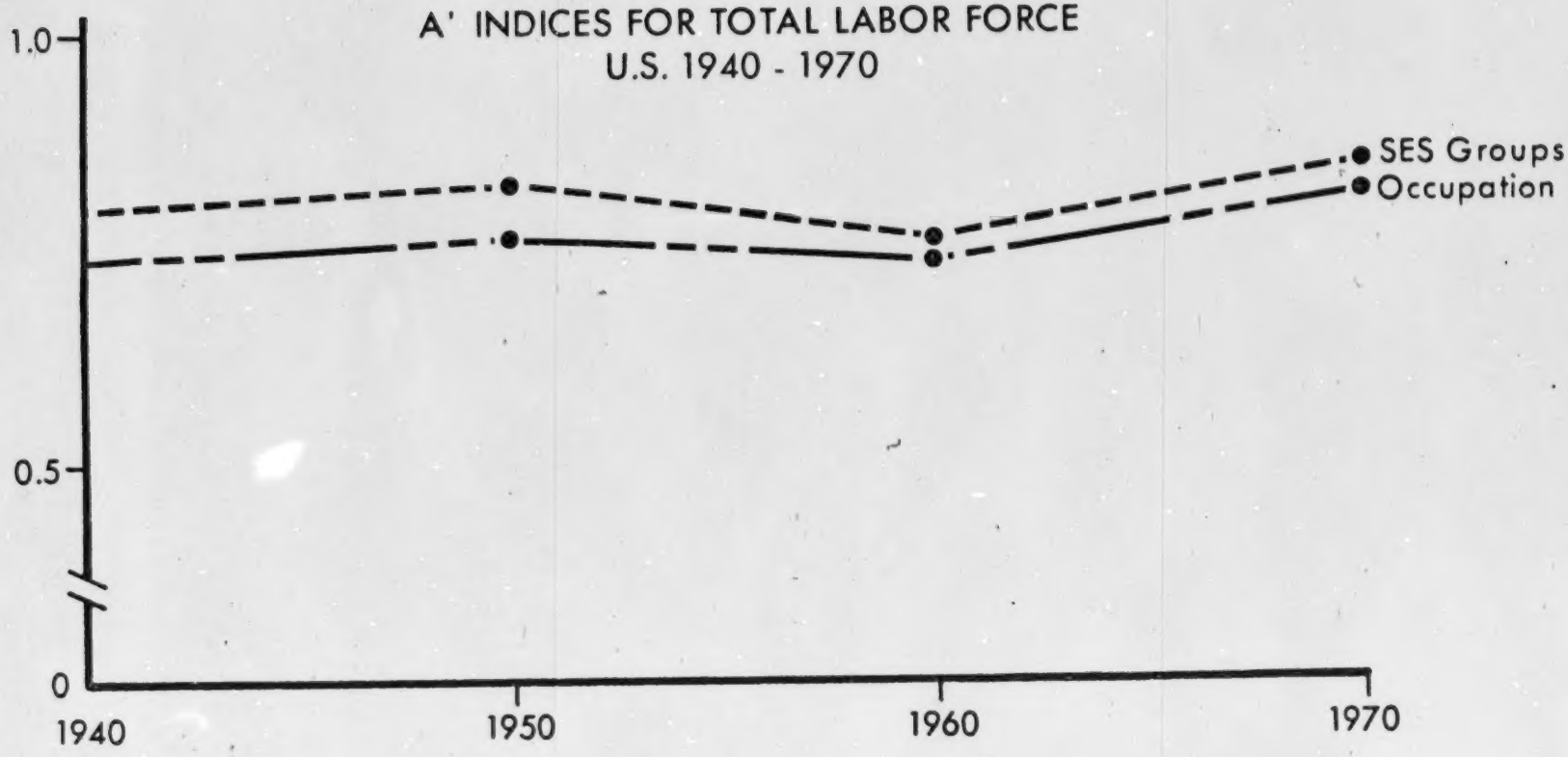

c' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
N.Y. 1960 - 1970
1.5
1.0
0.5
0
1960
1970
Managers & Officials
Service Workers
Laborers
Craftsmen & Foremen
Clerical & Sales
Professionals & Technical
Operatives

a''' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
N.Y. 1960 - 1970

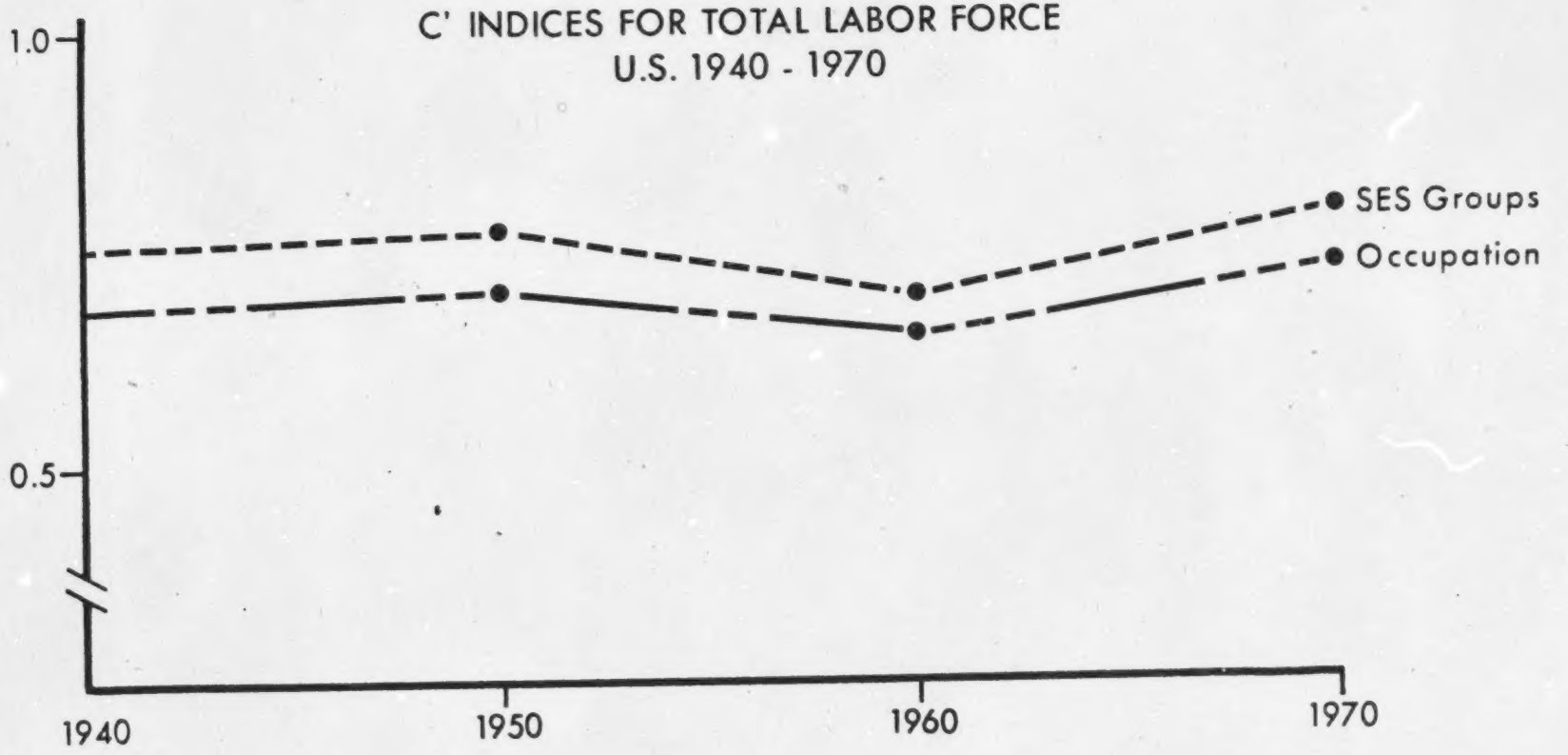


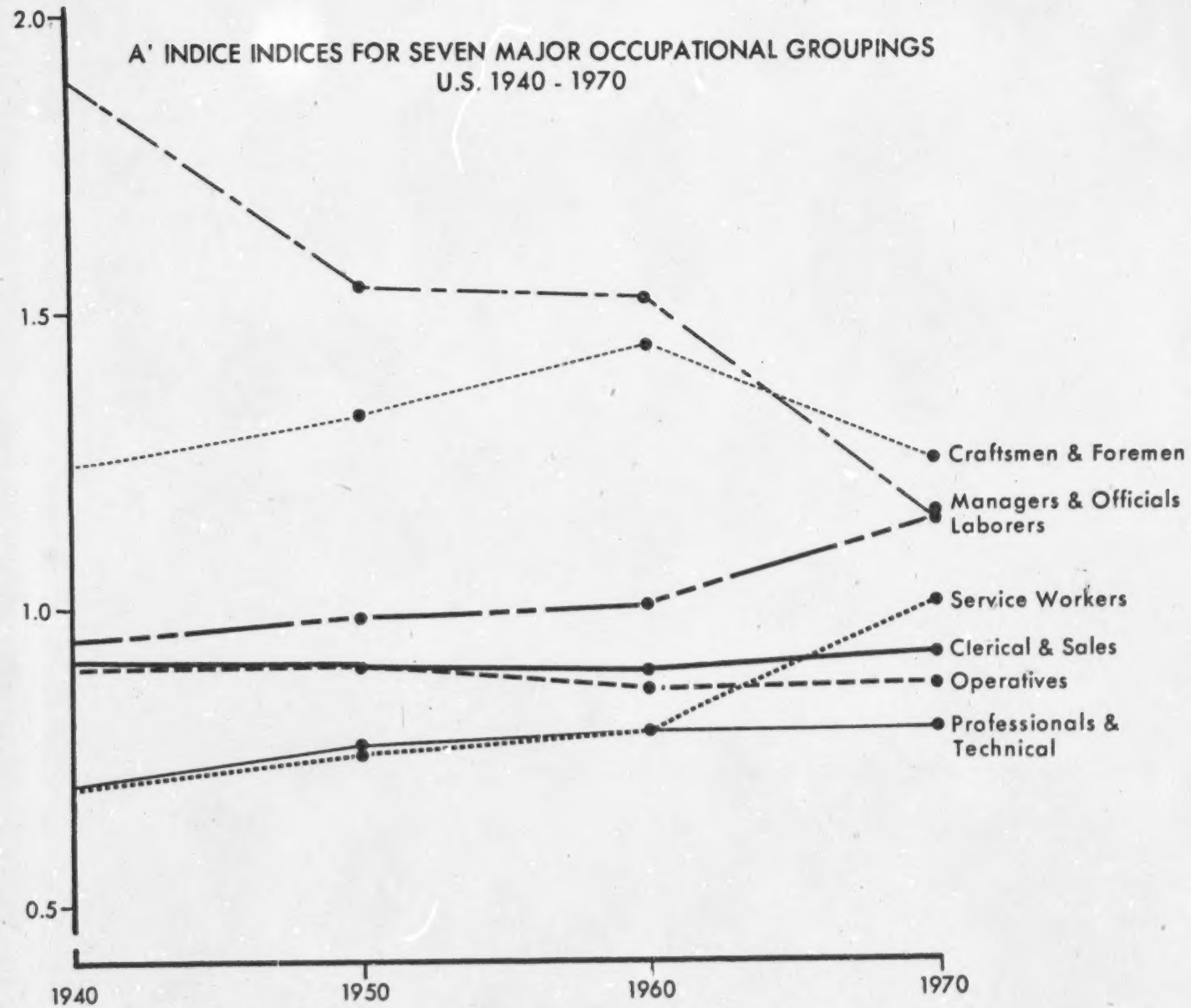
c''' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
N.Y. 1960 - 1970



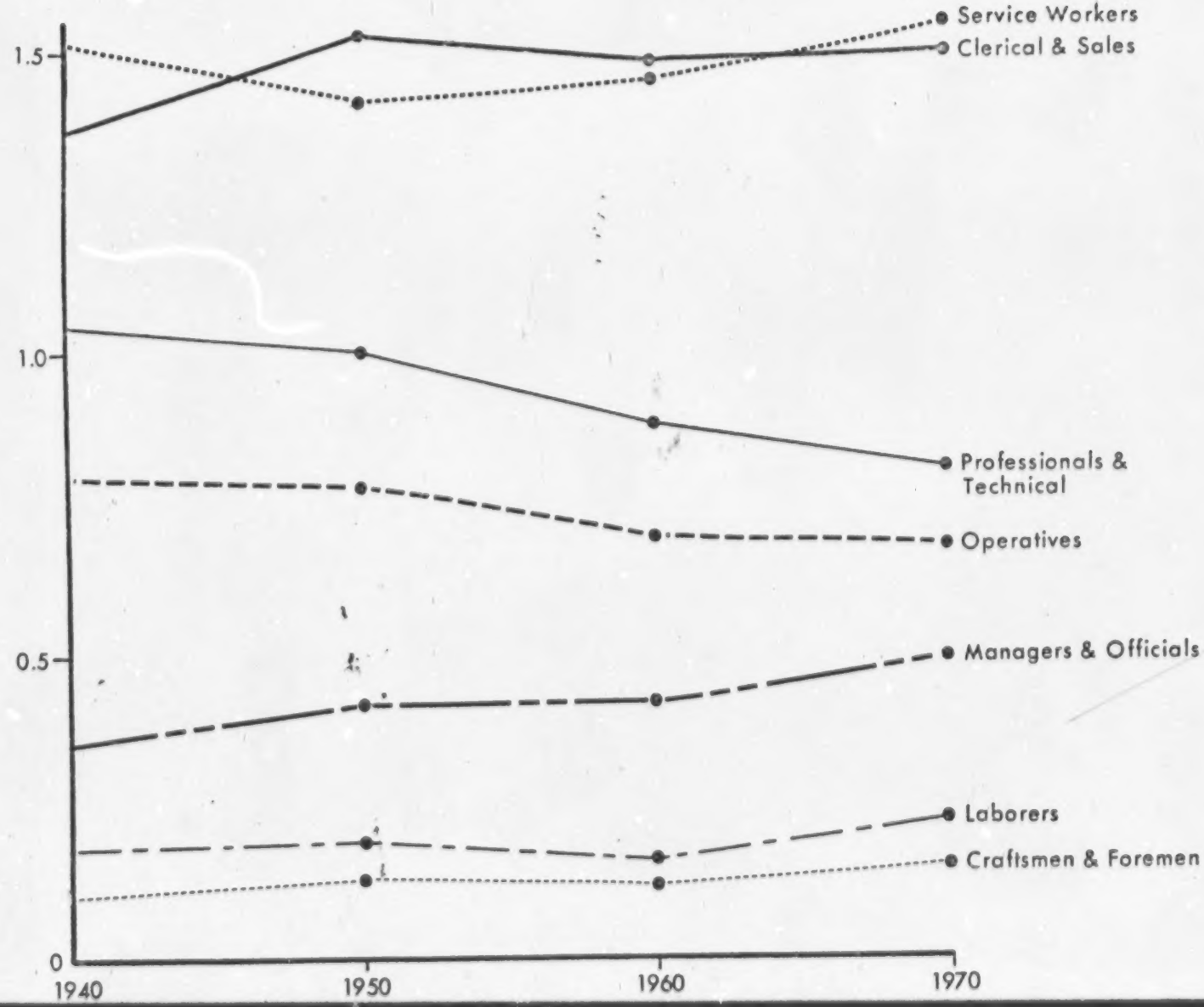

A' INDICES FOR TOTAL LABOR FORCE
U.S. 1940 - 1970
1.0
0.5
0
1940
1950
1960
1970
SES Groups
Occupation

C' INDICES FOR TOTAL LABOR FORCE
U.S. 1940 - 1970

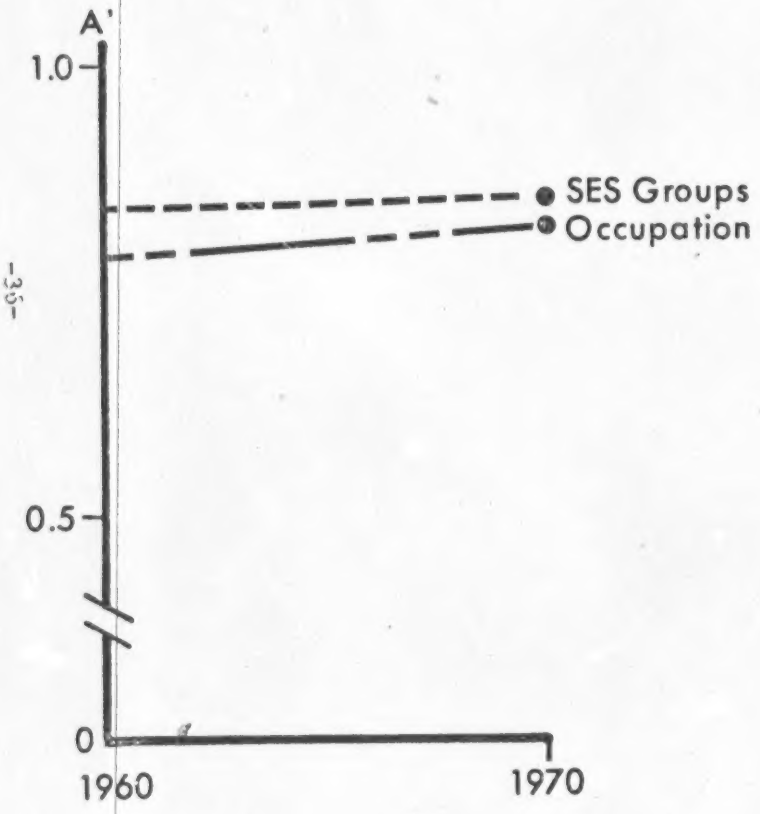


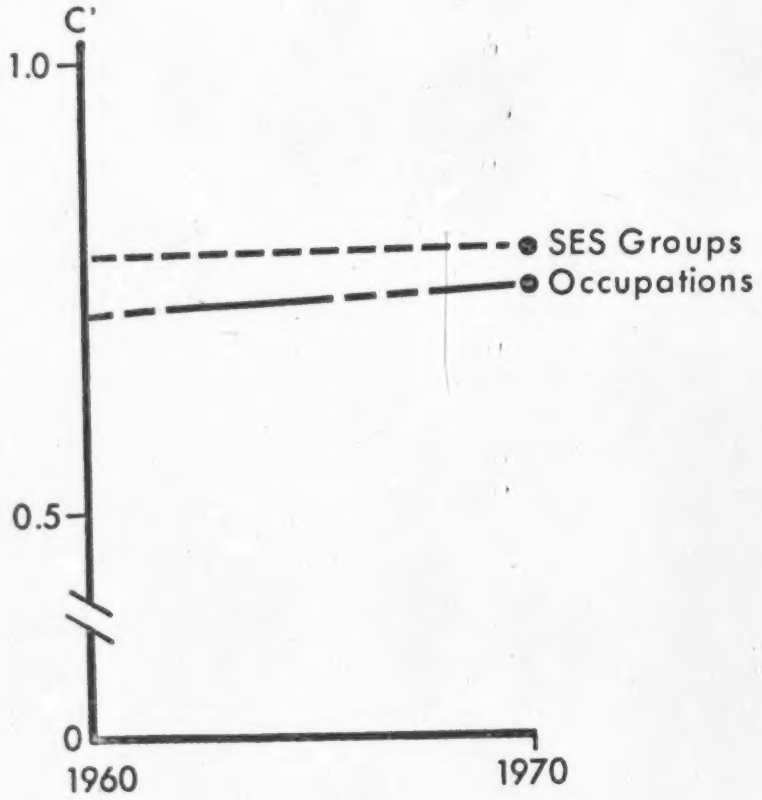

A' INDICE INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
U.S. 1940 - 1970
2.0
1.5
1.0
0.5
1940
1950
1960
1970
Craftsmen & Foremen
Managers & Officials
Laborers
Service Workers
Clerical & Sales
Operatives
Professionals &
Technical

A''' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
U.S. 1940 - 1970

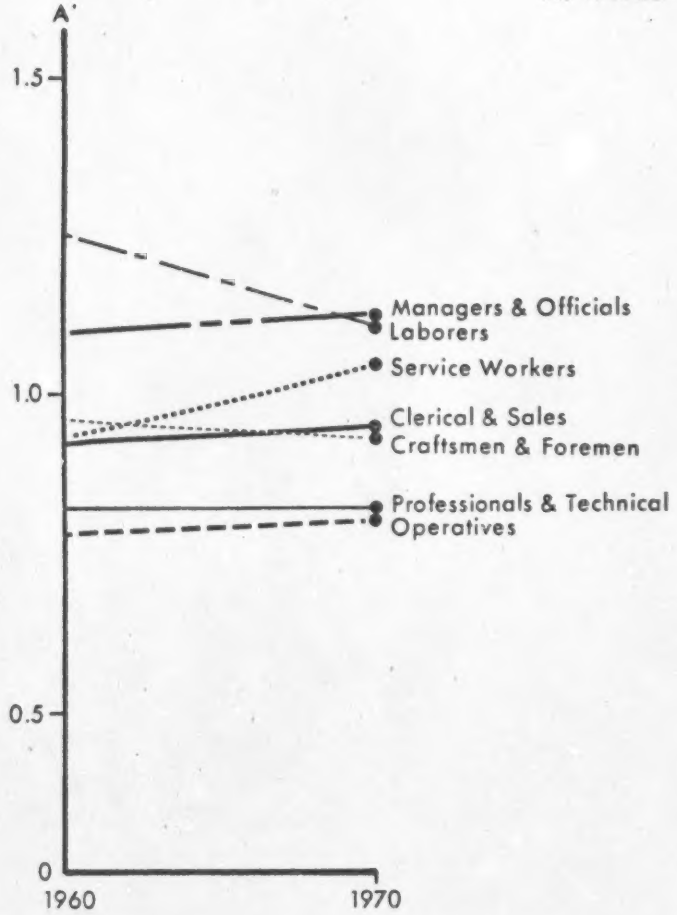


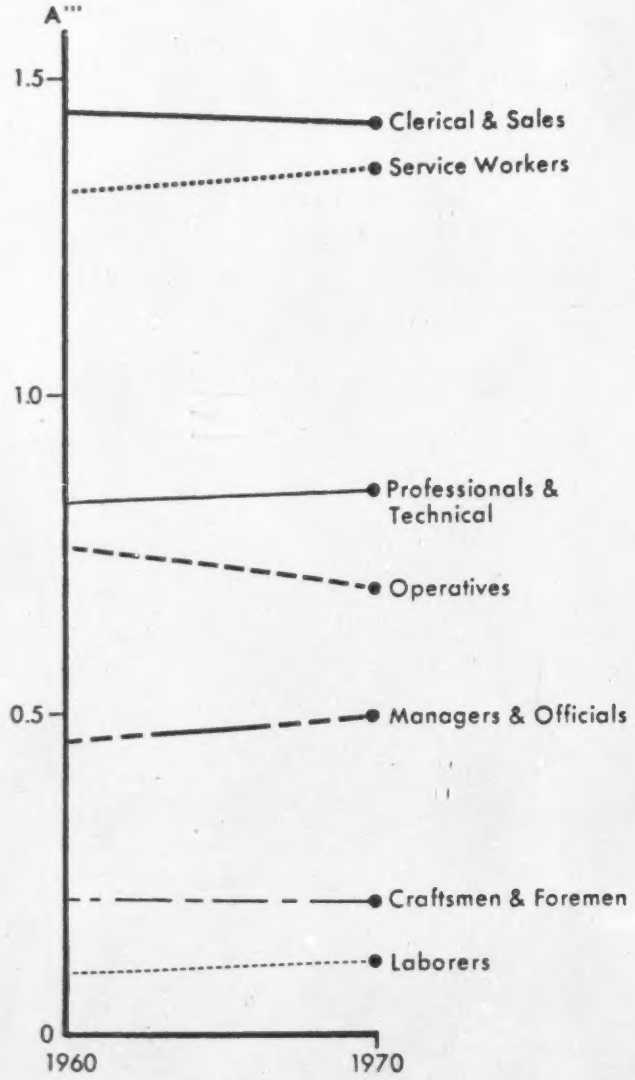
A' & C' INDICES FOR TOTAL LABOR FORCE
N.Y. 1960 - 1970





A' & A''' INDICES FOR SEVEN MAJOR OCCUPATIONAL GROUPINGS
N. Y. 1960 - 1970





Appendix C-1

Summary of Methodology

$$a' = \Sigma(f_i/1_i) \cdot SES/(\Sigma(F/L)SES_i)$$

$$A' = \Sigma SQRT(1_i/(1 - 1_i/L))(f_i\ 1_i)SES_i/\Sigma SQRT(1_i/(1 - 1_i/L))(F/L)SES_i$$

A', a' is an index of fairness of the distribution of women throughout a selected group of job categories relative to the proportion of women employed in the group of categories for which it is computed.

The "categories" can be individual occupations, some grouping of occupations by an SES score, or some grouping of occupations by a major characteristic. The "group" can be a major occupational type, or even the total labor force. For example, if the "categories" are individual occupations and the "group" is all professional occupations, the a' index would be a measure of the fairness of distribution of women workers throughout the professional occupations relative to the proportion of women professionals.

$a'' = a'/1+(1-a')$

a" is an index of fairness of the distribution of women throughout some group of job categories relative to the proportion of women employed in the group of categories for which a" is computed and to a measure of fairness of distribution of men throughout the same group of categories.

Because this index is constructed in a "short cut" method it does not always result in a "good" measure of fairness of male distribution. This in turn causes the a" measure to not always be a "good" measure of fairness of distribution.

If the "categories" are individual SES "groups" and the "group" is all SES groups then the a" index would be a measure of the fairness of distribution of women workers throughout all SES groups relative to a measure

of fairness of distribution of men throughout all SES categories and the proportion of women in all SES groups (i.e. since all occupations have SES scores, this becomes the proportion of women in the total labor force).

$$a''' = \sum_k (f_i/1_i)SES_i / \sum_k (F/L)SES_i$$

$$A''' = \sum_k SQRT(1_i/(1 - 1_i/L_k))(f_i/1_i)SES_i / \sum_k SQRT(1_i/(1 - 1_i/L_k))(F/L)SES_i$$

A''', a''' is an index of fairness of the distribution of women throughout the categories of some group relative to the proportion of women employed in the total labor force. Because the group of categories which determines the proportion of women workers with respect to which fairness of the distribution is judged is larger than the group of categories for which a' is computed, then the a''' index will be a measure of how far below or above the larger group proportion the primary group proportion is, as well as the fairness of distribution within the group itself.

If the categories are individual occupations and the group is again the professional group and the larger group is that of the total labor force, then the a''' index would be a measure of fairness of distribution of women workers throughout the professional occupations relative to the proportion of women in the whole labor force.

$$b' = \sum (m_i/1_i) \cdot SES_i / \sum (M/L)SES_i)$$

$$B' = \sum SQRT(1_i/(1 - 1_i/L))(m_i/1_i)SES_i / \sum SQRT(1_i/(1 - 1_i/L))(M/L)SES_i$$

B', b' is an index of fairness of the distribution of men throughout the categories of some group relative to the proportion of men employed in the group of categories.

All upper case indices take into account the importance of occupational size.

$$b''' = \sum_k (m_i/l_i)SES_i / \sum_k (M/L)SES_i$$

$$B''' = \sum_k SQRT(l_i/(1 - l_i/L_k))(M_i/l_i)SES_i / \sum_k SQRT(l_i/(1 - l_i/L))(M/L)SES_i$$

B''', b''' is an index of fairness of the distribution of men throughout the categories of some group relative to the proportion of men employed in the total labor force.

$c' = a'/b'$

$C' = A'/B'$

C', c' is an index of fairness of the distribution of women throughout the categories of some group relative to measure of fairness of distribution of men throughout the categories used in computing c' and to the proportion of women employed in the group of categories for which c' and C' is computed.

$c''' = a'''/b'''$

$C''' = A'''/B'''$

C' is superior to c' because it accounts for occupational size.

C''', c''' is an index of fairness of the distribution of women throughout the categories of some group relative to a measure of fairness of the distribution of men throughout the categories of the group used in computing c''' and to the proportion of women employed in the total labor force (The measure of fairness of distribution of men was computed relative to the proportion of men in the total labor force).

If the "categories" are individual occupations and the "group" is the sales and clerical occupations, then the c''' and C''' indices would be measures of fairness of distribution of women workers throughout the sales and clerical occupations relative to a measure of fairness of the distribution of men workers and to the proportion of women in the whole labor force.

All measures theoretically range between 0 and infinity with the exception of a" which ranges between minus and plus infinity. The usual range is between zero and two with indices occasionally taking on values beyond two.

Appendix C-2

Methodology In Detail

We can define an index as a neat, little "package of a number" that summarizes, and is constructed from, a not-so-neat bunch of information. We must realize that the index, constructed in some specific manner, will say no more to us than the information from which it was built. Also, the index must be interpreted in a manner consistent with its construction. Indices have no mystical value; their use and aid to understanding, however, outweigh most disadvantages.

The task before us is that of studying female occupational mobility. One way of doing this is to construct an index, or indices, of female occupational status and to compare values of the index, or indices, over time. For raw data, we use U.S. census data which give the number of persons by sex, employed in various occupational categories.

As an additional criterion for constructing an index of female occupational status we shall define as "ideal" the state in which women are employed in each occupational category in proportion to their participation in the entire U.S. labor force.

This appendix will detail some steps leading up to the construction of an index of female occupational status in which status ranking of occupations is accounted for. Various extensions and alterations of this index of female occupational status are discussed. Finally the last step in the development of the index is discussed. The index in its final stage of development accounts not only for the status of various occupations, but also for the importance of the proportions of females employed in occupations as a function of the total numbers employed in the various occupations.

If women workers were distributed evenly throughout occupational categories, we would expect that the proportion of women workers in each

occupational category would be equal to the proportion of women workers in the total labor force. Therefore, f_i = total number of women employees in occupational category i, and l_i = total workers in that occupational category. We expect that $f_i/l_i = F/L$ where F = total number of women in the labor force and L = total number of persons in the labor force. Of course, since the persons in any occupational category make up only part of the total labor force, the f_i/l_i values will not all be identically equal to the value of F/L, but will for an even distribution of women in the work force, fluctuate randomly about the value F/L.[1]

A simple and naive first try at creating an index of women's occupational status might consist of first computing the f_i/l_i value for each occupational category, second computing the mean of the f_i/l_i values and finally forming the ratio of this mean to the expected value of this mean (expected value of this mean is F/L). In symbol notation we write this index as

$$a = \frac{\bar{f}}{(F/L)} \quad \text{where } \bar{f} = \Sigma (f_i/l_i) /N$$

When women are distributed evenly throughout the work force, then the a will be equal to one. However, there are also many times when a would equal one even without an even distribution of women in the work force.

In addition to the already given criticism of general inadequacy of the index a, we also make two other criticisms for the purpose of introducing

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[1] If we assume that for each occupational category that employees are selected independently of one another with probability of choosing any woman equal to F/L and 1/L (the proportion of employees in this occupation of the total labor force) is small, then the selection of employees for each occupation at least with respect to sex approximates a sequence of infinitely repeatable trials and the proportion f/l will be approximately binomially distributed with the mean F/L and variance $(1-l_i/L)(F/L)(1-F/L)/l_i$

the formulation of a new index. First, a does not take into account any ranking of a job over another in terms of perceived status of the job, material income from the job, and education required for the job. Second, the index does not take into account the deviation of any particular f_i/l_i from F/L with respect to the number of persons employed within an occupational category. The resolution of the first criticism will require weighting of the index components by some measure of status, income, and/or education variables. Resolution of the second problem will require weighting of components of the index by some function of the number of employees for any occupational category. We consider the first problem for now.

In 1963, the U.S. Census bureau developed a ranking of occupations by socioeconomic status (SES).[2] The bureau developed a scale to measure the perceived status of occupations, the incomes and the educations associated with occupations, all based on 1959 data. On all three variables, the means of the rankings of occupations provided the SES rankings. All occupations were subsequently placed on a scale from one to ninety-nine.

The 1959-1960 socioeconomic status scale was deemed a refinement of the Edwards "social-economic" grouping hierarchical arrangement of occupations developed in 1917. The new SES structure was designed to overcome, by the incorporation of the income and education variables, the weaknesses inherent in early methods' heavy intuitive reliance on status. While clearly a variety of measurement problems may exist with the new SES scale, this scale is better than earlier systems of ranking occupations and is on par with most recent systems.

The 1960 census listed all occupations by SES grouping. The 1970 census

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[2] See Methodology and Sources of Socioeconomic Status, Working Paper No. 15, U.S. Department of Commerce, Washington, D. C. 1963.

listed those old jobs that existed in 1960 by the SES grouping, however jobs created since 1960 were not so catalogued. Using the Dictionary of Occupational Titles and the 1972 Department of Labor Handbook for Analyzing Jobs, the 1960 SES score hierarchy was updated for sixty-seven new occupations listed in the 1970 census data by considering the various relevant worker functions.[3] The new occupations were slotted into the 1960 SES scale. This revised scale allows for temporal consistency in analyzing the changes in relative status and vertical mobility of women based on the male-female percentage distributions in each category.

In constructing the a index so as to avoid the first criticism of not accounting for different status of jobs, we may weight each term of the numerator of the a index by the SES ranking of the occupation. To normalize the index we must accordingly weight each term of the denominator by the same SES scale value. We can write the revamped index as follows:

$$a' = (\Sigma(f_i/l_i) \cdot SES) \;/\; (\Sigma(F/L) \cdot SES_i)$$

The summation is over all occupational categories. When the index value is equal to one, then the distribution of women in the work force may be said to be even, but is more likely just balanced in the sense of balanced according to job status. We term this state of balance of a distribution as a "fair" distribution. When a' is less than one we might say that men are getting the better deal employmentwise, and when a' is greater than one, women are getting the better deal. Remember that this index is relative to the proportion of women in the total labor force and measures distribution of employment relative to this proportion.

If we desire an index of women's employment status relative to mens' employment status we could adopt the following quick, easy and imprecise

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[3] See Handbook for Analyzing Jobs, U.S. Dept. of Labor, Manpower Administration, 1972, U.S. Government Printing Office.

method of index construction. If a' is less than one we might say that there is a bias against women in employment and that 1-a' is some measure of this bias in favor of men. The ratio of our a index to the bias in favor might be used as an index of relative female employment status. We may write this index as:

$$a'' = a' / (1 + (1-a')$$

Another index of female employment status relative to male employment status that is not so quick and easy and is also more precise consists of creating an index of male occupational status in the same way as we did an index of female occupational status (rather than by the rather arbitrary manipulation of 1 = (1-a)) and forming the ratio of the two indices. We define an index of male occupational status as follows: $b' = (\Sigma(m_i/l_i).SES_i)/(\Sigma(M/L).SES_i)$ Everything that was said about the a' index applies to the b' index as well except that the index is that of male occupational status rather than female occupational status.

An index of female occupational status relative to male occupational status can be constructed as follows: c'=a'/b'. Again the same comments apply to c' as applied to a' and b' except that the index is that of female occupational status relative to male occupational status rather than status relative to the employment ideal of a fair distribution.

A number of extensions and variations on the a', a", b' and c' indices can be made. Examples are given in terms of the a' index but apply to a", b' & c' as well.

1. One such variation is to compute the index not from individual occupational categories (i.e. take weighted sums of f_i/l_i where each f_i/l_i comes from an occupation) but from groupings of occupations under common SES groupings. In this case there is an f_i/l_i computed for each SES group and

the weighted sum is taken over the ninety-nine SES groups. An index so computed is not a measure of fairness of distribution over occupational categories but rather a measure of fairness of distribution throughout SES groups.

2. Another variation is to confine oneself to a specific group of occupations such as professional occupations or managerial occupations[4] and compute the index value for occupations within this grouping. The index in this case is a measure of fairness of distribution of women workers within the occupations of that group relative to the proportion of women employed over all occupations in that group. This is the same use of indices as explained originally except that our list of occupations is only a sample of all the occupations. We may write the a index as follows:

$$a' = (\Sigma_k(f_i/l_i).SES_i)/(\Sigma_k(F_k/L_k).SES_i)$$

The summation (Σ) is over all occupations in the kth group. F_k and L_k represent the total number of women employees and the total number of employees regardless of sex in the kth group of occupations.

A modification of the indices discussed involves concentrating on a specific grouping of workers as was done in the second extension of the a' index, but in this case, changing the construction of the indices so that they will be a measure of the fairness of the distribution of women in the kth occupational group relative to the proportion of women employed in the whole work force. The change in structure of the index from the a' described in extension two would involve changing only the proportion used in the denominator. This changed index may be written as follows:

$$a''' = (\Sigma_k (f_i/l_i) SES_i)/(\Sigma_k (F/L) SES_i)$$

The summation is again over all occupations in the k^{th} group of occupations.

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[4] The major groupings are seven in number as follows: Professional, Managerial, Sales and Clerical, Operatives, Craftsmen, Service and Private Household, Laborer.

The F and L represent, respectively, the total number of women and of all persons regardless of sex in the entire labor force.[5] One can construct a b''' index analogous to the a''' index where b''' is written as follows:

$$b''' = ((m_i/l_i) SES_i)/((M/L) SES_i)$$

The b''' index is a measure of male occupational status relative to the proportion of males in the total labor force. Again we can construct a c index as the ratio of a and b indices to give us a measure of female status relative to male status instead of relative to some employment ideal. This index is constructed as follows: $c''' = a'''/b'''$.

If the group for which one is computing the a"' index is the total labor force then the value of a"' will be the same as the value of the a' index in which the sum for numerator and denominator is also over all elements and the proportion in the denominator becomes the proportion of women employed in the whole labor force. The same is true of the b"' and c"' indices.

The a and c indices with their extensions produce for each event to which they can be applied a measure of "fairness" of the distribution of females in the work force. An index value of one indicates a "fair" distribution. An even distribution (the ideal) would have an index value of one, and so, would be termed a fair distribution. A distribution in which female workers were employed in proportions greater than the ideal at both high and low SES ranked occupations and therefore at proportions lower than the ideal at middle SES ranked occupations, might still give an index value near one. Conceptually, we might think of a fair distribution

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[5] This index is a combined measure of two events which we choose (at least conceptually) to distinguish from each other. First there is the gross difference between the proportion of women in the labor force and the proportion of women in the kth subgroup of the labor force. Second, there is the difference among proportions in the individual occupations as is measured by the index discussed in extension number two.

of females through occupations as one in which females make up for a loss in some occupations by doing better in other higher ranked occupations.

The a, b and c indices, however, still suffer from the somewhat major failing of not accounting for the importance of various occupations as a function of the number of persons in the occupation. We develop below an index which meets this objection.

Recall from footnote 1, p. 2, that if we consider the employee of each occupation as a sample from a very large population, then the binomial probability model may be applicable and the variance and standard deviation of the female proportion for some occupation (f_i/l_i) may be written as follows:

$$\text{var}(f_i/l_i) = (1-l_i/L)(F/L)(1-F/L)/l_i$$

$$\text{st. dev.}(f_i/l_i) = \text{SQRT}(\text{var}(f_i/l_i)) = \text{SQRT}((1-l_i/L)(F/L)(1-F/L)/l_i)$$

The standard deviation f_i/l_i is a unit measure of dispersion of the distribution of f_i/l_i. For any occupation, i, that we treat as a sample from the labor force we may find the proportion f_i/l_i and its standard deviation. For any occupation, i, there is (given the assumptions of the binomial probability model) approximately a 67% probability f_i/l_i, being within one standard deviation of F/L. The standard deviation of f_i/l_i can thus be used as a measure of the importance of any deviation of f_i/l_i from F/L. The larger the standard deviation, the less important is a deviation of f_i/l_i from F/L for the probablity of f_i/l_i taking on a more extreme value is also greater. Reciprocally, the smaller the standard deviation, the more important any variation of f_i/l_i.

Since as the standard deviation becomes larger the importance of deviation of f_i/l_i becomes smaller, it seems feasible to weight the

$(f_i/1_i)$ SES_i terms by the inverse of the standard deviation. A common factor in the standard deviation for each occupation is (1-F/L)(F/L). Since this factor does not vary between occupations and hence is not discriminate, it is deemed unnecessary for inclusion in the index to be constructed.[6]

We are left to weight each $(f_i/1_i)$ (SES_i) term of the previous a and c indices and the $(m_i/1_i)$ (SES_i) terms of the b and c indices by $SQRT(1_i/(1-1_i/F))$. This weight is indeed primarily a function of the number of persons in the i^{th} occupation alone. A new index can be defined which weights not only by the status of occupations but also by the importance of occupations in terms of their size.

Recall the formula for the a' index: $a' = (\Sigma(f_i/1_i)SES_i)/(\Sigma(F/L)SES_i)$ analogous to a' is defined A' where A' is weighted by the function of occupational size as well as status. The A' index is constructed as follows:

$$A' = (\Sigma SQRT(1_i/(1-1_i/L))(f_i/1_i)SES_i)/(\Sigma SQRT(1_i/(1-1_i/L))(F/L)SES_i)$$

The A' index is conceptually the same as the a' index except for the fact that the A' index accounts for the size of the occupational groups.[7]

As we have defined A' analogous to a' so may we define β' to C':

$$\beta' = (\Sigma SQRT(1_i/(1-1_i/L))(m_i/1_i)SES_i)/(\Sigma SQRT(1_i/(1-1_i/L))(M/L)SES_i)$$

$$C' = A'/\beta'$$

We may go on to define a whole family of A, β, and C indices analogous to the extensions and modifications of the a, b and c indices:

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[6] Even if (1-F/L)(F/L) were included in the index, we could move it outside the summation in the numerator and denominator there to cancel each other out leaving a multiplier content of one.

[7] With the index a' a $f_i/1_i$ value of .20 when 1_i = one million persons and SES_i = 80 would be weighted the same as an $f_i/1_i$ value of .40 when 1_i = one thousand and SES = 80. The value of .20 for $f_i/1_i$ with 1_i = one million is however much more important.

1) The capital letters indices can be computed from SES groupings of occupations rather than from the individual occupations, 2) the capital letter indices can be computed over individual occupations for some major subgroup of occupations. A suitable formula for A' might be written as follows:

$$A'' = (\sum_k SQRT(1_i/(1-1_i/L))(f_i/1_i)SES_i)/(\sum_k SQRT(1_i/91-1_i/L))(F_k/L_k)SES_i)$$

where the summation $\sum_k$ is over the k^{th} major group of occupations and F_k/L_k is the proportion of women in the k^{th} major group. This index is the same as the original A' except that it is for something less than the total labor force.

A modification of the capital letter indices seems in order. We define A''', B''' and C''' indices analogous to the small letter indices. These indices also combine participation rate with fairness of distribution. The A''' index is written as follows:

$$A''' = (\sum_k SQRT(1_i/(1-1_i/L))(f_i/1_i)SES_i)/\sum_k SQRT(1_i/(1-1_i/L)(F/L)SES_i)$$

Where the summation is over the k^{th} occupational grouping and F/L is the proportion of females in the total labor force.

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